







Generic and disease-specific self-care instruments in older patients affected by multiple chronic conditions: A descriptive study

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Abstract

Aims: To describe and compare generic and disease-specific self-care measures in patients with multiple chronic conditions (MCCs) in the three dimensions of self-care maintenance, monitoring, and management.

Design: Multicentre cross-sectional study.

Methods: Patients aged 65 and over with MCCs. We used Self-Care of Chronic Illness Inventory to measure generic self-care, Self-care of Diabetes Inventory to measure self-care in diabetes mellitus, Self-Care of Heart Failure (HF) Index to measure self-care in HF, and Self-Care of Chronic Obstructive Pulmonary Disease Inventory to measure self-care in chronic lung diseases.

Results: We recruited 896 patients. Multimorbid patients with diabetes had lower scores on the self-care maintenance scale, and diabetic patients in insulin treatment on the generic management scale than on the disease-specific instrument. Multimorbid patients with HF or chronic lung diseases scored higher on generic self-care maintenance and monitoring scales than disease-specific ones. There was a partial consistency between the generic and disease-specific self-care maintenance and management. Inadequate behaviours were recorded in disease-specific self-care monitoring rather than generic ones.

Conclusions: Older patients affected by MCCs scored differently in the generic and disease-specific instruments, showing inadequate self-care in some of the three self-care dimensions.

Implications for the Profession and/or Patient Care: The choice between generic and disease-specific instruments to use in clinical practice and research should be made considering the specific aims, settings, patients characteristics, and knowledge of the different performance of the instruments by users.

Impact: No study has described and compared generic and specific self-care measures in patients affected by MCCs. Knowing these differences can help nurses choose the most suitable measure for their aims, context, and patients and plan generic and

disease-specific self-care educational interventions for those behaviours in which MCCs patients perform poorly.

Patient Contribution: Patients were informed about the study, provided informed consent, and answered questionnaires through interviews.

KEYWORDS

chronic illness, chronic obstructive pulmonary disease, diabetes, heart failure, instruments, self-care

1 | INTRODUCTION

The population is ageing worldwide (WHO, 2022). People 65 years or older make up 810 million of the world's population and are estimated to increase to 2 billion by 2050 (WHO, 2022). With the population ageing, the number of people living with multiple chronic conditions (MCCs), defined as the coexistence of two or more chronic illnesses in an individual, is expected to grow (Eurofound, 2023). In the United States, 63.7% of people aged 65 and over have at least two chronic conditions (Boersma et al., 2020); in Europe, these are approximately 37% (OECD, 2023). Diabetes Mellitus (DM), Chronic Obstructive Pulmonary Disease (COPD), and Heart Failure (HF) are the most prevalent and co-existing chronic condition in the older population (Hajat & Stein, 2018). In the United States, it is estimated that about 26.8% of older adults are affected by DM (National Diabetes Statistics, 2020), 5.3% by COPD (COPD Trends Brief: Prevalence, 2018), and 14.3% by HF (Heart Disease Prevalence, 2021). In Europe, about 8.3%, 4.5% and 2% of older adults are affected by DM, COPD and HF, respectively (Glance, 2020).

In response to the growing number of patients affected by chronic diseases, the promotion of self-care behaviours is considered a global priority to manage the diseases health and sustain health-care systems worldwide (WHO, 2018). WHO defined self-care as the 'ability of individuals, families and communities to promote health, prevent disease, maintain health, and cope with illness and disability with or without the support of a health worker' (WHO, 2019). Self-care behaviours decrease hospitalisations (Almutairi et al., 2020), mortality rate (Yu et al., 2022), and healthcare service utilization, and improve the quality of life of patients with chronic conditions (Rebora et al., 2021). However, self-care is difficult to perform because it requires patients to engage in several behaviours for a long time (e.g. adhering to a specific diet and/or taking a medicine for the rest of their life). In addition, when two or more chronic illnesses coexist, illness management becomes more challenging for patients due to the overlap of symptoms and the complexity of multiple treatments (Taylor et al., 2020).

Considering the importance of self-care in chronically ill patients, several valid, reliable, and theory-grounded instruments have been developed to measure self-care. These instruments can be distinguished into generic and disease-specific measures (Lawless et al., 2023; Packer et al., 2018). Generic measures, such as the Self-Care of Chronic Illness Inventory (SC-CII) (Riegel

What does this paper contribute to the wider global clinical community?

- Multiple chronic conditions are increasing worldwide due to the population ageing and many self-care behaviours performed by older patients affected by multiple chronic conditions are inadequate.
- Several valid, reliable, and theory-grounded instruments have been developed to measure generic and disease-specific self-care behaviours.
- The use of generic self-care instruments can be considered in case of the unavailability of a disease-specific instrument, the presence of more than one chronic condition, when not interested in disease-specific behaviours, and in case of time constraints. The use of a disease-specific measure may be more beneficial when a more accurate self-care monitoring evaluation is required.

et al., 2012), can be used regardless of the type and number of chronic conditions by which the patient is affected (Riegel et al., 2018). Disease-specific measures, such as the Self-care of Diabetes Inventory (SCODI) (Ausili et al., 2017), the Self-Care of Heart Failure Index (SCHFI) (Riegel, Barbaranelli, et al., 2019; Vellone et al., 2020), and the Self-Care of Chronic Obstructive Pulmonary Disease Index (SC-COPDI) (Matarese et al., 2020), can be used in patients affected by specific chronic conditions, such as DM, HF, and COPD, respectively.

The difference between the generic and disease-specific self-care measures is that generic measures capture self-care behaviours common in all chronic conditions, while disease-specific measures capture the self-care behaviours characteristic of a particular chronic condition. For example, the generic measure can assess how often patients monitor their conditions; the DM-specific measure can assess how often they monitor their blood sugar regularly; the HF-specific measure can assess how often patients check their ankles for swelling; and the COPD-specific measure can assess how often they monitor the colour and quantity of sputum.

The generic (SC-CII) and disease-specific instruments (SCODI and SC-COPDI) cited above were derived from the Middle-Range

Theory of Self-Care of Chronic Illness (Riegel et al., 2012), while the SCHFI was from the Specific Theory of HF Self-Care (Riegel et al., 2016; Riegel et al., 2022). According to these two theories, self-care is the process of maintaining health through health-promoting practices and managing illness and comprises three interrelated dimensions: (1) self-care maintenance, which includes the behaviours that patients with a chronic condition perform to maintain physical and emotional stability (e.g. following a specific diet); (2) self-care monitoring, which refers to control, surveillance and listening behaviours of one's own body aimed at recognizing a change in signs and symptoms (e.g. daily monitoring of body weight); and (3) self-care management which includes all behaviours performed to respond to signs and symptoms when they occur (e.g. modifying therapy as necessary) (Riegel et al., 2012). These generic and disease-specific instruments have been translated into many languages and used in many countries (www.self-caremeasures.com), and several studies have been conducted worldwide examining their psychometric properties. The SC-CII showed good validity and reliability on US (Riegel et al., 2018), Chinese (Jin et al., 2023), Italian and Swedish (De Maria et al., 2021) chronically ill patients, and on older adults living in a Middle-Income Country (Arapi et al., 2023). The SCODI has showed good validity and reliability in US (Ausili et al., 2020), Italian (Ausili et al., 2017; De Maria, Fabrizi, et al., 2022) Polish (Uchmanowicz et al., 2020), Korean (Kong & Cho, 2021), Farsi (Ebadi et al., 2019) and Spanish patients affected by DM. The SCHFI has showed good validity and reliability in US (Riegel et al., 2009), Italian (Vellone et al., 2013), Brazilian (Avila et al., 2013) Nepali (Koirala et al., 2020), Spanish (Juárez-Vela et al., 2021) patients with HF. The SC-COPDI presented good validity and reliability in Italian (Matarese et al., 2020), and Chinese (Wang et al., 2023) patients with COPD.

Generic and disease-specific self-care measures are helpful in clinical practice and research, as they allow nurses to assess patient performance of self-care behaviours over time, identify patients at high risk of inadequate self-care, and evaluate the efficacy of psychoeducational interventions aimed at improving self-care. The choice regarding the generic or disease-specific instrument to use in clinical practice and research can depend on several factors, including the unavailability of specific tools for all chronic diseases, the presence of more than one chronic condition, the need to evaluate the performance of specific behaviours considered important for the management of a specific disease, the rapidity of administration, and the knowledge of instruments by clinical or research nurses.

To our knowledge, no study has described and compared generic and specific self-care measures in patients affected by MCCs to determine if there are differences in capturing the self-care behaviours of patients with MCCs and which measures are appropriate to assess the patients' self-care behaviours. Knowing the differences in scores between the generic and disease-specific self-care instruments can help nurses choose the most suitable measure for their aims, context and patients and plan generic and disease-specific self-care educational interventions for those behaviours in which MCC patients perform poorly. Therefore, we conducted a study answer the following research questions:

1. What are generic and disease-specific self-care measures in patients with MCCs?
2. Are there differences between generic and disease-specific self-care measures in capturing self-care maintenance, monitoring, and management behaviours of patients with MCCs?
3. What measures are appropriate to evaluate the self-care behaviours of patients with MCCs?

2 | AIM

This study aimed (i) to describe generic and disease-specific self-care measures in patients with MCCs and (ii) to compare generic and disease-specific self-care measures in the three dimensions of self-care maintenance, monitoring, and management.

3 | METHODS

3.1 | Design

We performed a secondary analysis of the cross-sectional data of the 'Self-care of patient and caregiver DyAds in MCCs: A Longitudinal study (SODALITY)', an ongoing multicentre study aimed to describe self-care and caregiver contributions to patient self-care in MCCs context (De Maria et al., 2019). The STrengthening the Reporting of OBservational studies in Epidemiology (STROBE)-checklist (von Elm et al., 2008) were used for the reporting of the study (Data S1).

3.2 | Study setting and sampling

A convenience sample of patients affected by MCCs was enrolled in outpatient clinics and community settings. Patients were included if they (a) were 65 years or older, (b) received support from a family caregiver, and (c) had a diagnosis of DM, HF, or COPD and at least one additional chronic condition. We selected these chronic conditions as they represent the most prevalent chronic disease in older populations and are frequently associated with other chronic conditions (Hajat & Stein, 2018). Exclusion criteria were the presence of a clinical diagnosis of cancer and/or dementia. In the longitudinal study, we planned to recruit a sample of 1000 dyads at time 0 to obtain at least a sample of 500 chronically ill patient-caregiver dyads at time 2 (after 1 year), after estimating an attrition rate of 50% (De Maria et al., 2019).

3.3 | Data collection

Data were collected from April 2017 to November 2022. After selecting participants according to eligibility criteria, research assistants provided information about the study, acquired informed consent, and administered the instruments to patients. Participants

completed the instruments by themselves when they were able to do so or were supported by the research assistant when needed (e.g. for vision problems). The instrument completion required an average of 30 minutes.

3.4 | Instruments

The Self-Care of Chronic Illness Inventory (SC-CII) (De Maria et al., 2021; Riegel et al., 2018) version 2.0 was used for measuring the generic self-care behaviours. It is composed of 20 items that are grouped into the three scales of self-care maintenance (8 items) (e.g. do something to relieve stress), self-care monitoring (5 items) (e.g. pay attention to changes in how patient feels), and self-care management (7 items) (e.g. changing activity level to reduce the symptoms). Item #7 (measuring avoiding tobacco smoke) of the self-care maintenance scale was subsequently eliminated from the scale by developers. For this reason, it was not reported in the present study (De Maria et al., 2021; Riegel et al., 2018). SC-CII items use a 5-point Likert scale for responses from 1 (never) to 5 (always) for assessing the frequency of behaviours in the self-care maintenance and monitoring scales and from 1 (not likely) to 5 (very likely) for evaluating the probability of performing the behaviours in the self-care management scale. The SC-CII showed good validity and reliability properties. Specifically, it showed strong factorial validity in cross-cultural validation conducted on Italian, US, and Swedish samples of chronically ill patients, obtaining partial scalar invariance for all scales (comparative fit index [CFI] ranging from 0.95 to 0.99) (De Maria et al., 2021) and good internal consistency with reliability coefficients ranging between 0.67 and 0.86 across the three scales (Riegel et al., 2018).

The Self-Care of Diabetes Inventory (SCODI) (Ausili et al., 2017; De Maria, Fabrizi, et al., 2022) was used to measure the self-care of patients with Type 1 and 2 DM. This instrument is composed of 29 items grouped in the three scales of self-care maintenance (12 items) (e.g. performing physical exercise for 2 h and 30 min each week), self-care monitoring (8 items) (e.g. monitoring blood sugar regularly) and self-care management (9 items) (e.g. taking actions to regulate an abnormal blood sugar level). Patients taking insulin answer an additional question regarding adjusting insulin dosage in case of hyperglycaemia or hypoglycaemia ('If you find out that your blood sugar is too high or too low, do you adjust your insulin dosage in the way your health care provider suggested?'). SCODI items use a 5-point Likert scale for responses from 1 (never) to 5 (always). The SCODI showed good validity and reliability properties. Specifically, it demonstrated factorial validity in confirmatory factor analysis (CFA) with CFI ranging from 0.94 to 0.95 and from 0.96 to 0.99 on patient with Type 1 (T1DM) and 2 (D2TM) DM across the three scales, respectively (De Maria, Fabrizi, et al., 2022), good construct validity with glycated haemoglobin, body mass index, and diabetes complications (Ausili et al., 2017), and good reliability with coefficients ranging from 0.84 to 0.87 and from 0.83 to 1.00 in the T1DM and T2DM samples, respectively (De Maria, Fabrizi, et al., 2022).

The Self-Care of HF Index v. 6.2 (SCHFI) (Vellone et al., 2013) was used to measure self-care in HF. This instrument is composed of 16 items grouped into two scales: self-care maintenance (10 items) (e.g. eating a low-salt diet) and self-care management (6 items) (e.g. taking an extra water pill). In this version of the SCHFI, the two items measuring self-care monitoring behaviours (e.g. monitoring weight daily and checking ankle for swelling) were embedded in the self-care maintenance scale even though they clustered in a specific factor at CFA (Vellone et al., 2013). For the aim of this study, these two items were scored separately to have an HF self-care monitoring measure consistently with all other self-care instruments used in this study. In the SCHFI v.7.2, these two items were moved to the self-care monitoring scale. The SCHFI uses a 5-point Likert scale for responses from 1 (never) to 5 (always) for self-care maintenance and from 1 (not likely) to 5 (very likely) for the self-care management scale. The Self-Care Confidence scale, included in the SCHFI v.6.2, was not used in this study. Psychometric properties of the SCHFI v.6.2 were tested in Italian HF patients (Vellone et al., 2013). SCHFI showed good factorial validity in CFA (CFIs ranging from 0.92 to 0.99 across the three scales), known-groups validity (comparing HF patients followed in specialized clinics to patients followed in general outpatient cardiology practices), good internal consistency with reliability coefficients ranging from 0.74 to 0.90, and test-retest reliability measured by the Intraclass Correlation Coefficients [ICC] ranging from 0.64 to 0.80 across the three scale (Vellone et al., 2013).

The SC-COPDI (Matarese et al., 2020) v. 2.1 was used to measure self-care behaviours in COPD. It is composed of 32 items grouped into the three scales of self-care maintenance (13 items) (e.g. avoiding people with cold or flu), self-care monitoring (9 items) (e.g. monitoring for an increase in sputum quantity) and self-care management (10 items) (e.g. speaking to a healthcare provider [HCP] if the sputum changes colour or quantity). SC-COPDI use a 5-point Likert scale for responses from 1 (never) to 5 (always) for the self-care maintenance and monitoring scales and from 1 (not likely) to 5 (very likely) for the self-care management scale. In the developmental study, the SC-COPDI showed optimal structural validity in CFA (CFIs ranged from 0.95 to 0.99), good internal consistency measured by global reliability index for multidimensional scales ranging from 0.78 to 0.92, and test-retest reliability (ICCs) ranging from 0.77 to 0.88 across the three scales (Matarese et al., 2020).

Asymptomatic patients did not complete all the self-care management scales. In all these instruments, the scale scores were standardized from 0 to 100, with higher scores indicating better self-care. A score ≥ 70 is considered adequate self-care in all instruments (Riegel et al., 2009).

Finally, an ad-hoc structured questionnaire was used to collect participants' sociodemographic (e.g. age, sex, education level, presence of cohabitants, perceived income adequacy) and clinical (e.g. number of chronic conditions and severity class of patients' chronic conditions) characteristics. To identify the severity of DM, HF and COPD, the presence or absence of major/minor complications and

the need for insulin treatment, the New York Heart Association (NYHA) (American Heart Association, 2017) and the Modified Medical Research Council (mMRC) (Mahler & Wells, 1988) were used, respectively.

3.5 | Data analysis

Descriptive statistics (mean, standard deviation [SD], median, interquartile range [IQR], frequencies, and percentages) were used to describe the variables in the study. Paired Student's *t*-tests were used to compare generic and specific self-care scale scores of patients affected by DM, HF and COPD. We also analysed the mean scores of each item of the instruments (generic and disease-specific). We calculated a percentage of inadequacy for each item of the SC-CII, SCODI, SCHFI, and SC-COPDI, defined as the percentage of patients who scored ≤ 3 in the item, corresponding to the responses 'sometimes' or 'somewhat likely' in the Likert scale. This approach was previously used to define self-care inadequacy (Jaarsma et al., 2013). We used SPSS 22.0 software (IBM Corp) to analyse the data. A *p*-value $\leq .05$ was set as statistically significant.

3.6 | Ethical considerations

The study was carried out according to the principles of the Declaration of Helsinki. The 'SODALITY' study received the approval of the ethical committee of a regional healthcare system (ComEt ASReM #128-07/25/17). All data were treated confidentially, participation was voluntary, and all patients provided written informed consent. Participants were informed and identified with alphanumeric codes to assure privacy. The data were stored securely, with access limited to only the researchers.

4 | RESULTS

4.1 | Participants' characteristics

A sample of 896 patients affected by MCCs was enrolled. Fifty-four per cent of them were female, with a mean age of 77.13 (SD 7.40) years, 80.8% had ≤ 8 years of education. On average, they were affected by 3.25 (SD 1.31) chronic conditions; in particular, 66.3% of patients were affected by DM, and most of them (74.2%) did not report complications; 41.2% were affected by HF, and 51.2% of them were in NYHA class 2; 16.7% were affected by COPD, and 27.9% of them were in grade 1 on the mMRC. Every patient included in the study received support from at least one family caregiver, as it was a criterion for their eligibility. The sociodemographic and clinical characteristics of participants are presented in Table 1.

TABLE 1 Sociodemographic and clinical characteristics of patients with multiple chronic conditions ($N=896$).

Characteristics	N (%)
Gender	
Male	413 (46.1)
Female	483 (53.9)
Education level	
≤ 8 years	724 (80.8)
> 9 years	172 (19.2)
Living With	
Alone	166 (18.5)
1 person	464 (51.5)
More than 2 people	266 (30)
Perceived income	
Low than necessary to live	32 (3.57)
Enough/more than necessary to live	864 (96.4)
Patient multiple chronic conditions	
DM + other chronic disease	594 (66.3)
HF + other chronic disease	369 (41.2)
COPD + other chronic disease	150 (16.7)
HF + DM + other chronic disease	129 (14.4)
HF + COPD + other chronic disease	63 (7.03)
DM + COPD + other chronic disease	46 (5.1)
DM + COPD + HF	21 (2.3)
DM severity	
Without complications	441 (74.2)
With complications	153 (25.8)
Minor complications	115 (75.2)
Major complications	38 (24.8)
HF severity (Class NYHA)	
1	73 (19.8)
2	189 (51.2)
3	89 (24.1)
4	18 (4.9)
COPD severity (mMRC)	
0	20 (13.6)
1	41 (27.9)
2	37 (25.2)
3	30 (20.4)
4	19 (12.9)
	Mean (SD) Range
Age	77.13 (7.40) 65–101
Number of chronic conditions	Median [IQR]
	3.00 [2–4]

Abbreviations: COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; HF, heart failure; IQR, interquartile range; mMRC, Modified Medical Research Council; N, number; NYHA, New York Heart Association; SD, standard deviation.

4.2 | Generic and disease-specific self-care behaviours in patients with MCCs

Generic and disease-specific self-care behaviours performed by patients affected by MCCs were described and compared in Table 2.

4.2.1 | Self-care behaviours of patients affected by DM and other chronic conditions

Multimorbid patients affected by DM, on average, scored ≥ 70 (indicating adequate self-care level) in DM-specific self-care maintenance and on the generic self-care monitoring scale (72.06, SD 13.91

and 73.69, SD 20.47, respectively). Generic self-care maintenance and management (for patients in insulin treatment) scale scores were lower than the DM-specific ones (Δ self-care = -5.38 , $p < .001$; -2.37 , $p = .050$, respectively), and generic self-care monitoring was higher than DM-specific self-care monitoring scale scores (Δ self-care = 11.92 , $p < .001$).

4.2.2 | Self-care behaviours of patients affected by HF and other chronic conditions

Patients affected by HF reported adequate levels of self-care on the generic self-care monitoring scale (76.26, SD 20.02) but inadequate

TABLE 2 Description and Comparison of generic and disease-specific self-care instrument scores in patients affected by MCCs ($N = 896$).

Scale	SC-CII (N = 594) Mean (SD) Range	SCODI (N = 594) Mean (SD) Range	Δ self-care	t (p-value)
Self-care maintenance	66.68 (14.69) 17.86–100	72.06 (13.91) 6.26–100	-5.38	-9.07 (<.001)
Self-care monitoring	73.69 (20.47) 0–100	61.77 (20.20) 8.83–100	11.92	13.11 (<.001)
Self-care management				
Insulin treatment (N = 203)	62.67 (17.45) 0–100	65.04 (17.62) 5.56–100	-2.37	-1.95 (.050)
No insulin treatment (N = 391)	58.31 (19.97) 0–100	59.38 (21.29) 0–100	-1.07	-.55 (.580)
	SC-CII (N = 369) Mean (SD) Range	SCHFII (N = 369) Mean (SD) Range	Δ self-care	t (p-value)
Self-care maintenance	66.12 (15.24) 17.86–100	53.55 (14.17) 0–100	12.57	17.66 (<.001)
Self-care monitoring	76.26 (20.02) 0–100	56.34 (23.75) 0–100	19.92	14.86 (<.001)
Self-care management (N = 170)	57.80 (19.97) 0–100	56.29 (20.03) 0–100	1.51	1.03 (.31)
	SC-CII (N = 150) Mean (SD) Range	SC-COPDI (N = 150) Mean (SD) Range	Δ self-care	t (p-value)
Self-care maintenance	66.73 (14.70) 17.86–100	61.05 (15.64) 3.85–92.31	5.68	2.74 (.007)
Self-care monitoring	73.73 (20.48) 0–100	62.99 (24.83) 0–100	10.74	7.16 (<.001)
Self-care management (N = 128)	60.22 (19.53) 0–100	59.98 (24.36) 0–100	.24	1.33 (.185)

Note: To compare generic and disease-specific self-care scores the student's t-tests were tested. Δ self-care represents the difference between generic and specific self-care scores (SC-CII and SCHFI, SC-CII and SC-COPDI, and SC-CII and SCODI).

Abbreviations: SC-CII, self-care of chronic illness inventory; SCHFI, self-care of heart failure index; SC-COPDI, self-care of chronic obstructive pulmonary disease inventory; SCODI, self-care of diabetes inventory; SD, standard deviation; t, Student's t-test; Δ , delta.

in HF-specific self-care maintenance, monitoring, and management scales (53.55, SD 14.17, 56.34, SD 23.75 and 56.29, SD 20.03, respectively). Generic self-care maintenance and monitoring scale scores were higher than HF-specific ones (Δ self-care=12.67, $p < .001$; 19.92, $p < .001$, respectively).

4.2.3 | Self-care behaviours of patients affected by COPD and other chronic conditions

We found that, on average, patients with COPD scored adequate on the generic self-care monitoring scale (73.73, SD 20.48) but inadequate on COPD-specific self-care maintenance, monitoring, and management scales (61.05, SD 15.64, 62.99, SD 24.83 and 59.98, SD 24.36, respectively). The mean scores of generic self-care maintenance and monitoring scales were higher than those of COPD-specific self-care maintenance and monitoring scales (Δ self-care=5.68, $p = .007$; 10.74, $p < .001$, respectively).

4.3 | Item descriptions of generic self-care behaviours

A detailed description of the mean scores for SC-CII items is presented in Table 3. Regarding self-care maintenance, patients who reported a score below adequate levels (scored ≥ 3 on the Likert scale) in practising physical activity and relieving stress were 72.43% and 64.17%, respectively. A total of 92.63% of patients reported adequate behaviours (scored ≥ 4 on the Likert scale) in taking prescribed medicines without missing a dose (Table 3). In the self-care monitoring scale, 41.7% of patients were inadequate in monitoring their medication' side effects, while 73.55% were adequate in paying attention to changes in how they felt physical and psychologically. Finally, in self-care management, 72.8% of the patients scored, on average, below the adequate level by thinking that the last treatment used made them feel better. In generic self-care management, 71.62% of the patients reported adequate behaviours in regularly reporting the symptoms to their healthcare provider.

4.4 | Item descriptions of diseases-specific self-care behaviours

On the DM-specific self-care maintenance scale, 59.5% and 56.8% of patients with DM scored, on average, below the adequate levels in maintaining an active lifestyle and avoiding eating salt and fast food, respectively; in the self-care monitoring scale, 64.4% patients in monitoring weight; and in the self-care management scale, 79.3% patients in adjusting physical activity to modify blood sugar, 65.2% in recording the events that caused abnormal blood sugar levels, and 52.8% in asking a family member when blood sugar levels were abnormal. Patients reported an adequate level of keeping appointments

TABLE 3 Item scores of the self-care of chronic illness inventory (SC-CII) and inadequacy percentage ($N = 896$).

Item of self-care maintenance scale ($N = 896$)	Mean	SD	Inadequacy (n, %)
1. Make sure to get enough sleep?	3.73	1.05	385, 43.19
2. Try to avoid getting sick (e.g. flu shot, wash your hand)?	4.26	.95	198, 22.10
3. Do physical activity (e.g. take a brisk walk, use the stairs)?	2.73	1.32	649, 72.43
4. Eat special food or avoid certain food?	3.19	1.28	525, 58.59
5. Keep appointments for routine or regular health care?	4.02	1.05	265, 29.58
6. Take prescribed medicines without missing a dose?	4.67	.68	66, 7.37
7. How often do you avoid cigarettes and tobacco smoke) §			
8. Do something to relieve stress (e.g. mindfulness, yoga, music)?	3.06	1.31	575, 64.17
Item of self-care monitoring scale			
9. Monitor your condition?	4.07	.95	246, 27.46
10. Pay attention to changes in how you feel?	4.08	.94	237, 26.45
11. Monitor for medication side-effects?	3.67	1.22	374, 41.74
12. Monitor whether you tire more than usual doing normal activities?	3.91	1.04	306, 34.15
13. Monitor for symptoms?	4.01	1.02	260, 29.02
14. The last time you had a symptom, how quickly did you recognize it as a symptom of your health condition?	3.00	1.44	505, 66.23
Item of self-care management scale			
15. Change what you eat or drink to make the symptom decrease or go away?	3.22	1.23	478, 62.81
16. Change your activity level (e.g. slow down, rest)?	3.26	1.24	445, 58.48
17. Take medicine to make the symptom decrease or go away?	3.42	1.28	397, 52.17
18. Tell your healthcare provider about the symptom at the next office visit?	4.07	1.09	216, 28.38
19. Call your healthcare provider for guidance?	3.63	1.34	327, 42.97
20. Think of a treatment you used the last time you had symptoms	2.82	1.33	554, 72.80
Did the treatment you used to make you feel better?			

Note: Inadequacy describes the number and percentage (%) of patients who scored ≤ 3 to the Likert scale of each item; §, item 7 was not reported because it was removed from the scale by the developers in the following version.

Abbreviations: N, Number; SC-CII, self-care of chronic illness inventory; SD, standard deviation.

with healthcare providers, monitoring blood sugar regularly, and adjusting the insulin dosage as recommended by their physician (adequate in 87.7%, 69.8% and 78.3%, respectively) (Table 4).

On the HF-specific self-care maintenance scale, 58% of patients affected by HF scored, on average, below the adequate level in eating low-salt foods when visiting family and friends, 61% in monitoring weight daily, and 64.1% in reducing fluid intake when symptomatic. A total of 97.0% of patients reported an adequate level of taking prescribed medicine regularly, and 72.4% regularly calling healthcare providers for guidance (Table 5).

On the COPD-specific self-care maintenance scale, 88.7%, 78.7% and 76.0% of patients affected by COPD scored, on average, below the adequate levels in performing arm exercises, using abdominal or lip breathing techniques, and engaging in social activities, respectively; on the self-care monitoring scale, 45.3% of patients in checking side effects of inhaled medications; and in the self-care management scale, 60.4% in sitting when bathing, and 47.1% in sitting doing house work when breathless. A total of 75.3% and 77.3% of patients reported adequate levels of monitoring for an increase in breathlessness and cough, respectively (Table 6).

5 | DISCUSSION

To our knowledge, this is the first study to describe and compare generic and disease-specific self-care measures in a sample of older patients affected by MCCs in the three dimensions of self-care maintenance, monitoring, and management. These findings are important because they can inform investigators and clinicians about the extent to which generic and disease-specific measures capture self-care behaviours performed by patients with MCCs. We found differences in the level of self-care measured by generic and disease-specific self-care instruments.

In our study, in the generic self-care instrument, multimorbid patients affected by DM and those receiving insulin treatment presented lower self-care maintenance and self-care management scores compared to the DM-specific instrument. The disease-specific instrument will likely allow patients to recognize which disease-maintenance behaviours to consider in their responses. In fact, even though the two instruments have five self-care maintenance behaviours in common (e.g. doing physical activity, following a specific diet, preventing infection, keeping medical appointments, and taking medicines following the prescription), the DM-specific self-care maintenance scale considers more behaviours specific for diabetic patients, such as care of the feet, oral hygiene, limitation of alcohol use, and doing specific exams to identify diabetes complications. The higher level of self-care maintenance detected by the DM-specific instrument could be explained by the greater education that these patients, in general, receive from healthcare professionals (Al-Hariri et al., 2017; Yu et al., 2023). In the self-care monitoring scale, patients reported higher scores in the generic self-care instrument than in the disease-specific one. This could be determined by the fact that the generic self-care monitoring scale items refer to nonspecific behaviours (e.g. monitor your condition),

allowing the patients to respond by thinking about any symptom of a chronic disease from which they are affected (it may be the easiest to monitor or the one that the patient monitors more frequently or effectively). Conversely, in the self-care management scale administered to patients undergoing insulin treatment, the items of the disease-specific self-care measure require the patient to reflect on a specific behaviour performed to manage a symptom. Patients with chronic conditions, especially those affected by DM, may be more likely to prioritize a problem (e.g. a sign/symptom) if they find it relatively easy or realistic, important, particularly urgent to address, comfortable to discuss, and/or something they have been told to do or think they 'should' work on (Hessler et al., 2019).

Multimorbid patients affected by HF scored higher in generic self-care maintenance and monitoring scales than in disease-specific ones. This means that a disease-specific instrument can detect lower self-care behaviour performance. This could be explained by the difficulty that older patients encounter in performing specific self-care maintenance (e.g. getting some exercise for 30 minutes daily) and monitoring (e.g. checking ankles for swelling) behaviours and by the greater level of detail of the disease-specific self-care measure compared to the generic one. Therefore, it is likely that the generic instrument may overestimate the self-care monitoring behaviours of MCC patients because it leaves it to the patient to interpret which clinical manifestation to think about.

Similarly to patients with HF, patients affected by COPD scored higher in generic self-care maintenance and monitoring scales than in disease-specific ones. This shows the difficulty of older patients in performing regular specific self-care maintenance (e.g. using abdominal or closed-lip breathing to regulate breathing) and monitoring behaviours (e.g. checking for side effects of inhaled medication), which require specific education (Lei et al., 2023; Su et al., 2023). As previously indicated, the generic instrument may overestimate the self-care monitoring level of patients because the decision regarding which clinical manifestation to consider is left to the patient.

Concerning self-care behaviours measured by specific items, some common results emerged regardless of the instrument (generic or disease-specific). Regarding self-care maintenance behaviours, all instruments detected as inadequate those behaviours related to diet adherence and physical activity, and as adequate the behaviours related to activities directed to avoid getting sick. Consistent with previous research, our results show that chronically ill patients have difficulty adhering to healthy behaviours related to diet and physical activity for extended periods (Middleton et al., 2013). On the contrary, our sample showed adequate adherence to treatments and check-up behaviours, although previous studies found a low therapeutic adherence in older patients (Morrell et al., 1997). We could hypothesise that older patients in our sample, whose mean age was 77 years, were supported in treatment adherence by an informal caregiver, whose presence was an inclusion criterion of our study. Previous studies (De Maria, Ausili, et al., 2022; Riegel et al., 2017) have shown that informal caregivers who care for patients with chronic illnesses provide crucial support in the patient's self-care. For example, caregivers support patients in adhering to therapy, in

TABLE 4 Item scores of self-care of diabetes inventory (SCODI) and inadequacy percentage (N = 594).

Item of self-care maintenance scale (N = 594)	Mean	SD	Inadequacy (n, %)
1. Maintain an active lifestyle (e.g. walking, going out, doing activities)?	3.13	1.32	354, 59.50
2. Perform physical exercise for 2 hours and 30 minutes each week? (e.g. swimming, going to the gym, cycling, walking)	1.99	1.30	501, 84.20
3. Eat a balanced diet of carbohydrates (pasta, rice, sugars, bread), proteins (e.g. meat, fish, legumes), fruits and vegetables?	3.75	1.07	240, 40.34
4. Avoid eating salt and fats (e.g. cheese, cured meats, sweets, red meat)?	3.37	1.12	338, 56.81
5. Limit alcohol intake (no more than 1 glass of wine/day for women and 2 glasses/day for men)?	4.29	1.14	118, 19.83
6. Try to avoid getting sick (e.g. wash your hands, get recommended vaccinations)?	4.25	.95	136, 22.86
7. Avoid cigarettes and tobacco smoke?	4.53	1.21	76, 12.77
8. Take care of your feet (wash and dry the skin, apply moisture, use correct socks)?	3.87	1.18	202, 33.97
9. Maintain good oral hygiene (e.g. brush your teeth at least twice/day, use mouthwash, use dental floss)?	3.96	1.05	182, 30.59
10. Keep appointments with your health care provider?	4.54	.79	73, 12.27
11. Have your health check-ups on time? (e.g. blood tests, urine tests, ultrasound, eye exams)?	4.52	.80	75, 12.62
12. Many people have problems taking all their prescribed medicines. Do you take all your medicines as your health care provider prescribed (please also consider insulin if your doctor prescribed it for you)?	4.39	.99	93, 15.63
Item of self-care monitoring scale (N = 594)			
13. Monitor blood sugar regularly?	4.07	1.09	180, 30.25
14. Monitor weight?	3.14	1.18	383, 64.37
15. Monitor blood pressure?	3.62	1.09	277, 46.55
16. Keep a record of blood sugars in a diary or notebook?	2.92	1.64	352, 59.16
17. Monitor the condition of feet daily to see if there are wound, redness or blisters?	3.47	1.29	293, 49.24
18. Pay attention to symptoms of high blood sugar (thirst, frequent urination) and low blood sugar (e.g. weakness, perspiration, anxiety)?	3.91	1.12	192, 32.27
The last time you had symptoms			
19. How quickly did you recognize that he or she was having symptoms?	2.94	1.56	380, 63.87
20. How quickly did you know that the symptoms were due to diabetes?	2.93	1.61	364, 61.18
Item of Self-Care Management scale (N = 594)			
21. To check your blood sugar when you experience symptoms (e.g. thirst, frequent urination, weakness, sweating, anxiety).	3.75	1.21	231, 38.82
22. When you have abnormal blood sugar levels, make note of the events that may have caused the situation and the actions you took.	2.87	1.37	388, 65.21
23. When you have abnormal blood sugar levels, ask a family member or friend for advice.	3.31	1.22	314, 52.77
24. When you have symptoms and find that your blood sugar is low, eat or drink something with sugar to solve the problem.	3.85	1.22	199, 33.45
25. If you find your blood sugar is high, you adjust your diet to fix it.	3.66	1.13	258, 43.36
26. If you find your blood sugar is high, to adjust physical activity to solve it?	2.51	1.29	472, 79.33
27. After taking actions to regulate an abnormal blood sugar level, recheck blood sugar to see if the actions were effective.	3.61	1.26	264, 44.37
28. If you find that your blood sugar is very low or very high, call your doctor for advice.	3.55	1.33	262, 44.03
If you take insulin, please answer the following question.			
29. If you find that your blood sugar is too high or too low, you adjust the insulin dosage as recommended by your doctor (N = 203)	4.18	1.24	44, 21.67

Note: Inadequacy describes the number and percentage (%) of patients who scored ≤ 3 to the Likert scale of each item.

Abbreviations: N, number; SCHFI, self-care of heart failure index; SD, standard deviation.

TABLE 5 Item scores of the self-care of heart failure index (SCHFI) and inadequacy percentage ($N=369$).

Item of self-care maintenance scale ($N=369$)	Mean	SD	Inadequacy n (%)
3. Try to avoid getting sick (e.g. wash your hand)?	4.22	1.06	57 (15.45)
4. Get some exercise (e.g. take a brisk walk, use the stairs)?	2.96	1.34	203 (55.01)
5. See your health care provider for routine health care?	4.60	.78	21 (5.69)
6. Eat a low-salt diet?	3.51	1.28	143 (38.75)
7. Get some exercises for 30minutes daily?	1.97	1.09	316 (85.64)
8. Take prescribed medicine?	4.80	.62	12 (2.98)
9. Ask for low-salt food when visiting family and friend?	2.91	1.38	214 (57.99)
10. Use a system or method to help you remember to take your medicines?	3.55	1.49	132 (35.77)
Item of self-care monitoring scale ($N=369$)			
1. Monitor weight daily	2.85	1.24	225 (60.98)
2. Check ankles for swelling	3.66	1.15	108 (29.27)
Item of self-care management scale ($N=170$)			
12. In the past month, if you had trouble breathing or ankle swelling, how quickly did you recognize them as symptoms of heart failure?	2.80	1.43	102 (60.00)
13. To reduce the salt in the diet	3.16	1.40	83 (48.82)
14. To reduce fluid intake	2.68	1.13	109 (64.12)
15. To take an extra water pill	2.95	1.42	92 (54.12)
16. To call the doctor or nurse for guidance	3.82	1.14	47 (27.65)
Think of a remedy you tried the last time you had trouble breathing or ankle swelling:			
17. How sure were you that the remedy helped or did not help?	3.20	1.34	57 (33.53)

Note: Inadequacy describes the number and percentage (%) of patients who scored ≤ 3 to the Likert scale of each item.

Abbreviations: N, number; SCHFI, self-care of heart failure index; SD, standard deviation.

maintaining physical (e.g. smoking cessation, preparing healthy food) and emotional stability (e.g. managing stress), in changing in their behaviour when symptoms occur (De Maria, Ausili, et al., 2022), etc. Even during the COVID-19 pandemic, despite the limitation imposed by pandemic, informal caregivers managed to continue to support multimorbid patients in performing self-care, for example, by replacing them in activities outside the home to prevent infections, promoting good nutrition and adherence to treatments with constant monitoring (De Maria, Ferro, et al., 2022).

Another explanation could be that patients reported taking their medications regularly even though they did not since they were not fully aware of the prescribed treatment and the related instructions. For example, patients can report using an inhaler prescribed for COPD but use it once a day instead of twice or do not use the proper technique to inhale the drug dose. Qualitative studies should be conducted to explore what patients mean when they report adhering to prescriptions.

Regarding self-care monitoring, the inadequacy of monitoring behaviours such as the daily monitoring of weight, foot conditions (swelling or wounded, redness and blisters), cough, dyspnoea, and side effects of drug inhalers, are evident in the specific self-care measures, but not in the generic ones. These results highlight that the generic measure is less sensitive to assessing disease-specific self-care monitoring behaviours of DM, HF, and COPD. In MCCs, some of these behaviours can be complex to perform, and overlapping symptoms can make their recognition difficult and their correct association with the chronic condition that caused it. Consequently, this can lead to problems in performing adequate management (Taylor et al., 2020).

Finally, there is a partial consistency between the generic and specific measurements regarding self-care management behaviour items. In particular, the inadequacy in contacting HCP when symptoms occur emerges in both generic and disease-specific measures. The generic measure seems to underestimate the ability of patients with MCCs to change what they drink or to modify the prescribed therapy according to the HCP's instructions when symptoms occur. We found that generic and disease-specific self-care instruments can evaluate self-care behaviours differently. Our results highlight the peculiarity of SC-CII, SCODI, SCHIFI, and SC-COPDI in measuring self-care behaviours based on how the item is specified. If a patient with chronic illness is asked how often they monitor their condition, they score higher than when a specific self-care monitoring behaviour (e.g. weighing every day or observing sputum colour) is indicated. This could be because the item refers to monitoring behaviours that the patient can interpret according to their knowledge, experience or illness characteristics. In the second case, the item could be more explicit and turn out to be less interpretative.

The Middle-Range Theory of Self-Care of Chronic Illness (Riegel et al., 2012), and the Situation-Specific Theory of HF Self-Care (Riegel et al., 2016; Riegel et al., 2022), from which these instruments are derived, distinguish between different dimensions of self-care behaviours (i.e. self-care maintenance, monitoring, and management) allowing us to identify which types of self-care behaviours are least implemented by chronically ill patients. Our results showed, for example, that self-care management behaviours were those which, regardless of the instrument—generic or disease-specific—used to measure them, were consistently performed less by all patients regardless of their diseases. This finding identifies a critical issue for patients and a priority area of education by clinicians and by study for researchers.

TABLE 6 Item mean scores of the self-care of chronic obstructive pulmonary disease inventory (SC-COPDI) and inadequacy percentage (N = 150).

Item of self-care maintenance scale (N = 150)	Mean	SD	Inadequacy (n, %)
1. Avoid people with colds or flu	3.58	1.39	66, 44.00
2. Move away from the room/place where someone is smoking	3.63	1.52	59, 39.33
3. Avoid contact with sprays, paints, solvents and dust	3.87	1.29	53, 35.33
4. Keep my lungs free by coughing or with deep breathing if needed	3.87	1.20	87, 58.00
5. Pause during my daily activities to rest	3.96	1.09	52, 34.67
6. Use abdominal breathing or pursed lips breathing to regulate my breath	2.55	1.25	118, 78.67
7. Regularly do some form of exercise (e.g. walking, cycling, swimming, etc.)	2.33	1.36	116, 77.33
8. Exercise with my arms at least 3 times a week?	1.81	1.16	133, 88.67
9. Engage in social activities with other people at least once a week	2.48	1.40	114, 76.00
10. Get a flu vaccination every year	4.27	1.38	29, 19.33
11. Take the medicines as prescribed by my healthcare provider	4.83	.55	6, 4.00
12. Protect my mouth/nose when I walk outdoors and the air is cold	3.57	1.47	63, 42.00
13. Make regular visits to my healthcare provider for checks-ups of my chronic lung disease	4.48	.99	24, 16.00
Item of self-care monitoring-scale (N = 150)			
1. Monitor for an increase in sputum quantity	3.76	1.37	42, 28.00
2. Monitor for a change in sputum colour	3.70	1.38	46, 30.67
3. Monitor for an increase of coughing	4.15	1.09	37, 24.67
4. Monitor for an increase in breathlessness or whistles	4.18	1.08	34, 22.67
5. Monitor whether I wake up during the night with trouble breathing	3.73	1.38	47, 31.33
6. Check whether I struggle to fall asleep due to trouble breathing	3.67	1.28	53, 35.33
7. Monitor whether I get tired more than usual when I do something	4.08	1.07	39, 26.00
8. Check for palpitations, tremor, insomnia, dry mouth and difficulty at urinating after taking inhaled medications	3.05	1.43	68, 45.33
Item of self-care management scale (N = 128)			
1. Talk to my healthcare provider if I have problems with prescriptions for my chronic lung disease	3.94	1.27	43, 36.13
2. Go to my healthcare provider if I have any health problem that lasts for more than a few days	3.99	1.13	42, 35.29
3. Speak to my healthcare provider if I feel that the breathlessness has increased	3.97	1.21	41, 34.45
4. Speak to my healthcare provider if I feel that the cough has increased	3.79	1.30	45, 37.82
5. Speak to my healthcare provider if the sputum changes colour	3.59	1.40	46, 38.60
6. Speak to my healthcare provider if the amount of sputum increases	3.59	1.42	45, 37.80
7. Speak to my healthcare provider if I get side effects from my inhaled medicines (e.g. tremor, insomnia, dry mouth, difficulty urinating)	2.98	1.58	31, 26.05
8. When the symptoms of my illness worsen, I modify prescribed therapy as my healthcare provider told me to do (e.g. take cortisone and/or an antibiotic)	3.83	1.40	45, 37.82
9. Sit doing housework when I have breathlessness	3.65	1.42	56, 47.06
10. When I have breathlessness, sit on a chair or on another support when I shower or use the bathtub	3.03	1.61	72, 60.50

Note: Inadequacy describes the number and percentage (%) of patients who scored ≤ 3 to the Likert scale of each item.

Abbreviations: N, Number; SCOPDI, Self-Care of Chronic Obstructive Pulmonary Disease Inventory; SD, Standard Deviation.

5.1 | Implication for practice, research, and theories

Our results have important implications for clinical practice, research, and theory advancement. Our study shows that a generic self-care instrument (SC-CII) may overestimate the self-care behaviours performed by multimorbid patients since, when they respond to generic and limited in number questions regarding self-care behaviours, they

can interpret them in a general way or not think of a specific behaviour that could be important for their self-care. Therefore, the use of SC-CII may be considered, for example, in case of the unavailability of an instrument for a specific illness, in the presence of more than one chronic condition, when the nurse is not interested in disease-specific behaviours, and in case of time constraints. The disease-specific measure, where available, may be considered by nurses when they want to accurately evaluate self-care monitoring

behaviours specific to a chronic condition (e.g. tracking blood sugar for DM, checking ankles for swelling for HF or checking for side effects of inhaled medications for COPD). Disease-specific self-care instruments allow for identifying patients at high risk of performing inadequate self-care, selecting which self-care behaviours to address in the educational interventions and evaluating their efficacy.

Choosing the most appropriate instruments for measuring self-care behaviours in different chronic conditions is crucial for researchers to study the self-care process. Identifying the measure that best captures the researchers' behaviours of interest can contribute to advancing the knowledge of the self-care process and how this correlates with predictive variables and clinical outcomes in different care contexts and in single and MCCs.

Further research should investigate why people answer in different ways when compiling instruments assessing similar self-care behaviours and identify the reasons for performing poor self-care.

5.2 | Strengths and limitations

This study has several strengths. It is the first study to simultaneously use generic and specific measurements to describe and compare the self-care level of older adults with MCCs in the three theoretical dimensions of self-care maintenance, monitoring, and management. The large sample size and the use of valid and reliable self-care measures represent further strengths of this research. Finally, the use of a theoretical framework (Riegel et al., 2012; Riegel et al., 2016; Riegel et al., 2022; Riegel, Jaarsma, et al., 2019) widely used in the context of chronic diseases empowered the study and could contribute to further theoretical development.

Nevertheless, this study presents limitations. First, we enrolled a convenience sample of patients. Although we balanced this limitation with a multicentre enrolment, our results cannot be generalized to the population with MCCs. Second, we enrolled participants in only one European country. Consequently, our results should be generalized with caution to populations of other countries. Third, the majority of enrolled patients were relatively stable, with few in advanced disease stages; consequently, our findings may not be generalizable to patients experiencing higher levels of clinical instability or those in advanced stages of diseases. Future research should describe and compare generic and specific self-care measures of chronically ill patients from other countries, cultures and those in different disease stages. Lastly, due to the non-standardized data collection procedure, which included both face-to-face interactions and self-reported instrument completion, there is a potential for recall bias.

6 | CONCLUSION

Our results contribute to the growing body of research on self-care behaviours in chronic conditions. This study suggests that older adult patients affected by MCCs perform inadequate self-care behaviours, with potential negative consequences on their outcomes.

Investigators are encouraged to reflect further on the reasons for poor self-care behaviours in patients with MCCs and continue to explore interventions to improve their self-care. This study also suggests evaluating and choosing the most appropriate instrument for measuring self-care behaviour considering the clinical or research aims, settings, and patient characteristics.

AUTHOR CONTRIBUTIONS

All the authors are entitled to authorship and meet the criteria for authorship. **Maddalena De Maria**: Writing—original draft, Visualization. **Maddalena De Maria**: Conceptualisation, Formal analysis. **Manuela Saurini, Ilaria Erba** and **Maddalena De Maria**: Data curation, Investigation. **Ercole Vellone, Davide Ausili** and **Maria Matarese**: Conceptualisation, Methodology. **Ercole Vellone, Barbara Riegel** and **Davide Ausili**: Writing—review & editing, Visualization. **Maria Matarese**: Conceptualisation, Methodology, Project administration, Supervision. All the authors approved the final version of the manuscript.

ACKNOWLEDGEMENTS

This work was supported by grants (2.15.11) from the Centre of Excellence for Nursing Scholarship (CECRI), Rome, Italy. The statistics were checked prior to submission by an expert statistician: Maddalena De Maria maddalena.demaria@outlook.it.

FUNDING INFORMATION

This work was supported by grants (2.15.11) from the Centre of Excellence for Nursing Scholarship (CECRI), Rome, Italy.

CONFLICT OF INTEREST STATEMENT

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

Our data are available on request to be addressed to the Corresponding Author.

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SUPPORTING INFORMATION

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How to cite this article: Maria, M. D., Saurini, M., Erba, I., Vellone, E., Riegel, B., Ausili, D., & Matarese, M. (2024). Generic and disease-specific self-care instruments in older patients affected by multiple chronic conditions: A descriptive study. *Journal of Clinical Nursing*, 00, 1–14. <https://doi.org/10.1111/jocn.17397>