





Factors associated with self-care in adults with cancer receiving oral anticancer agents: A sex-stratified Bayesian analysis

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ABSTRACT

Purpose: This study aims to assess self-care (SC) levels in Italian cancer patients receiving Oral Anticancer Agents (OAAs) and to identify their predictors, stratified by sex.

Methods: This is a cross-sectional analysis involving 518 cancer patients treated with OAAs across five Italian oncology centres. Sociodemographic, clinical, and psychosocial data (e.g., self-care, self-efficacy, social support, depression, patient-centredness, mutuality) were collected using validated instruments. Bayesian t-tests and sex-specific regression models were performed.

Results: Among 518 cancer patients treated with OAAs, men had significantly higher SC management scores than women, while no significant sex differences were found in SC maintenance or monitoring. In men, self-efficacy, mutuality, and depressive state strongly predicted self-care domains. In women, self-efficacy and perception of centrality were key predictors.

Conclusion: Self-efficacy plays a key role in promoting SC behaviour in cancer patients under OAA. However, relational and perceptual factors - such as centrality, mutuality and social support - play a complementary role, modulated by sex and stage of the SC process. Such evidence suggests the usefulness of personalized interventions that enhance the psycho-social dimension and sex differences in promoting SC.

1. Introduction

Worldwide, cancer is a major population health burden, accounting for thousands of new diagnoses. In the United States - between 2014 and 2018 - the total cancer incidence rate per 100,000 population was 457.5 with male individuals having higher rates (497.4) than female

individuals (430.9) (Siegel et al., 2024). In Europe, in 2020, more than 2.7 million people were diagnosed with cancer; it is estimated that one in two European citizens will develop cancer in their lifetime, and that about half of all cases will survive (Commission, 2022). Moreover, males were more likely than females to die from cancer (23.8 %) compared to 19.4 % (Eurostat, 2024). In Italy, in 2022 there was an incidence of

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667.7 new cases/100,000 men, and an incidence of 508.4 new cases/100,000 women (AIOM, 2024).

Traditionally, cancer treatments were mainly delivered intravenously. However, over the last two decades, cancer therapies have progressively shifted from 'traditional' intravenously administered cytotoxic agents to Oral Anticancer Agents (OAA) (Leong et al., 2021; Moreira et al., 2022). The introduction of OAA offers several distinct advantages and effective alternatives to traditional intravenous treatments (Eek et al., 2016; Talens et al., 2021). Although these medicines offer new avenues for treatment delivery, patient comfort, and improved quality of life (Moreira et al., 2022; Tichy et al., 2020), it should be considered that OAAs can be dangerous for patients if not handled safely.

For individuals living with cancer and treated with OAA, self-care (SC) is a key component in disease management and the maintenance of well-being. SC has been defined as a process that equips patients with the knowledge and skills necessary to actively engage in and take responsibility for the maintenance, monitoring, and management of their disease. Self-care maintenance, monitoring, and management are three distinct concepts. Self-care maintenance refers to patients' ability to adhere to adequate behaviours for stabilizing their illness. Self-care monitoring pertains to patients' ability to monitor for any sign or symptom related to their illness and its treatment. Finally, self-management is patients' ability to act if they recognise any sign of relapse or worsening of their condition (Riegel et al., 2012).

SC has been studied extensively in chronic diseases such as heart failure (Vellone et al., 2020), diabetes mellitus (Ausili et al., 2017), chronic obstructive pulmonary disease (Clari et al., 2017), and in patients with colostomy and urostomy (Villa et al., 2019). In these conditions, several factors have been associated with SC behaviours, including patient-centred care, self-efficacy, social support, depression, and mutuality in relationships. Patient-centred care, as defined by the Institute of Medicine, respects and responds to individual patients' needs, values, and preferences, positioning the patient as an active participant in their care (America, 2001). It aims to tailor care to the individual, enhancing outcomes. The importance of a patient-centred approach is also endorsed by the American Society of Clinical Oncology - ASCO (Hart et al., 2024), particularly in improving quality of life, trust in healthcare teams, and treatment effectiveness (Elkefi and Asan, 2023). Moreover, a patient-centred approach can enhance self-care behaviours, consequently improving clinical outcomes (Asmat et al., 2022).

Another factor that can influence self-care behaviours is self-efficacy. Self-efficacy is defined as the confidence that one has in the ability to perform a specific action (Bandura, 1986). Self-efficacy has been shown to be effective on self-care in patients with chronic conditions (Juarez et al., 2021; Tan et al., 2021) and may potentially have a significant impact on cancer patients' self-care behaviours.

Several studies have found lower levels of SC when patients receive poor social support (Ausili et al., 2018; Freedland et al., 2021), are depressed (Dickson et al., 2011; Egede et al., 2009; Freedland et al., 2021; Riegel et al., 2011) and have less mutuality (e.g., a worse relationship) (Hooker et al., 2018; Vellone et al., 2018).

Sex may also influence SC behaviours. In chronic conditions such as heart failure, diabetes, and hypertension, Chronic Obstructive Pulmonary Disease, and Heart Failure studies showed that SC behaviours are different by sex (Ausili et al., 2018; Caruso et al., 2020; Dellafiore et al., 2018; Heo et al., 2008; Salim et al., 2019; Younas et al., 2024). Some studies noted that male patients tend to exhibit lower SC levels than females (Ausili et al., 2018; Dellafiore et al., 2018; Salim et al., 2019). However, findings are not always consistent (Delgado et al., 2021). The influence of caregiver sex on patient SC has also been investigated. One study found that female caregivers were associated with better collaborative care and improved SC capacity in patients with heart failure (Bidwell et al., 2015). Another study showed that male patients with multiple chronic conditions, assisted by female caregivers, exhibited

more SC behaviours (De Maria et al., 2023).

Sex differences in oncology care are widely recognized across contexts (Csuka et al., 2024; Laghousi et al., 2019; Zhang et al., 2025). Indeed, a retrospective analysis of 185,967 colon cancer patients highlighted significant sex differences in clinical, histopathological, therapeutic, and outcome factors (Schmuck et al., 2020). Another study reported that women have a 34 % higher risk of developing severe toxicity compared to men (Özdemir et al., 2022). Few studies have examined SC behaviours in patients on OAAs. A recent systematic review (Di Nitto et al., 2022) found that while patients engage in various SC behaviours, most of the focus remains on treatment adherence. Another review (Ucciero et al., 2024) identified predictors of SC such as age, sex, education, side effects, comorbidities, and polypharmacy. However, most existing research is limited to adherence-related behaviours, and a comprehensive understanding of SC in patients receiving OAAs is lacking.

Thus, further research is needed to clarify how different personal and contextual factors, including sex, influence self-care behaviours in patients treated with OAAs. The aim of this study was to: (1) determine the levels of SC maintenance, SC management, and SC monitoring in Italian patients with cancer receiving OAAs; and (2) identify the predictors of SC in this population, with specific attention to sex differences.

2. Methods

2.1. Study design

This was a cross-sectional analysis of a broader longitudinal observational study conducted across five inpatient and outpatient Italian Oncology Units. Patients were recruited between November 2022 to April 2024. For comprehensive reporting of this study, we used the *Strengthening the Reporting of Observational Studies in Epidemiology* (S.T.R.O.B.E) (von Elm and Vandembroucke, 2008) guideline for cross-sectional studies (Supplementary File 1).

2.2. Sample, setting and procedures

A convenience sample of 518 patients with cancer receiving OAA treatment was enrolled in the study. Patients were recruited from five outpatient clinics in Italy, located in the three macro areas of the Italian territory (e.g., north, centre and south). Patient inclusion criteria were: (1) adult patients (≥ 18 years); (2) ability to give informed consent; (3) diagnosis of a metastasised or locally advanced solid tumour; (4) understanding of the Italian language; (5) active treatment with OAAs (conventional chemotherapy, molecular targeted therapy, hormone therapy) started since at least 3 months. This interval was chosen because a minimum period of 3 months was considered sufficient to rule out an immediate change of therapy due to the patients' lack of tolerability to the OAA. Patients were excluded if they had a diagnosis of haematological malignancy, melanoma or serious cognitive impairment which could prevent them from understanding the meaning of the items. Patients were approached by trained research assistants during outpatient visit. Due to the flexibility of the sampling strategy, Bayesian analysis typically does not require a priori sample size estimation (Stefan et al., 2019; Visser et al., 2024).

2.2.1. Data collection

2.2.1.1. Dependent variables. SC behaviours were measured by means of the Self-Care of Oral Anticancer Agents Index (SCOAAI). The SCOAAI is a 32-item valid and reliable instrument (Di Nitto et al., 2025b; Lacarbonara et al., 2023) composed by three scales: SC maintenance (15 items) that assess behaviours that help maintain the patient's health (e.g. attend all medical visits as schedule); SC monitoring (11 items) that assess behaviours aimed at monitoring symptoms associated with OAA

side effects (e.g. cancer medication side effects); SC management (6 items) that assesses behaviours implemented in the event of worsening symptoms associated with OAA treatment (e.g. contact the doctor or nurse to ask what to do in case of unmanageable symptoms). All items are rated on a 5-point Likert scale format. The SC maintenance and monitoring scales range from 1 (Never) to 5 (Always), while the SC management scale ranges from 1 (not at all likely) to 5 (Totally likely). Every scale has a standardized score between 0 and 100, where higher scores correspond to better SC.

2.2.2. Independent variables

Several instruments, reported below, were used to evaluate the SC of patients under OAAs.

Patient sociodemographic (e.g., age, sex) and clinical data (e.g., primary tumour site, type of OAA, months of treatment, etc.) were collected through a specific and structured sociodemographic and clinical questionnaire created by the research team.

The patient centredness was measured with the Patient Perception of Patient centredness Scale - revised version (PPPC-R) (Ryan et al., 2019). It consists of 18 items and three factors: the healthcare process (items 1–8) (e.g., to what extent was your main problem(s) discussed today?), roles (items 9 and 10) (e.g., to what extent did you and your provider discuss your respective roles?) and context and relationship (items 11–18) (e.g., to what extent does your provider know about your family life?). Each item has a 4-point Likert scale, with responses ranging from 1 (very much) to 4 (not at all). Higher scores indicate a lower level of patient-centredness, while the overall score is the mean score of all the questions. The internal consistency was tested with Cronbach's alpha coefficient, which was 0.981 in our sample.

The Self-Care Self-Efficacy Scale was used to investigate the patient's SC efficacy (Di Nitto et al., 2025a). This scale consists of 10 items (e.g. Routinely monitor your health condition?) and all items are rated on a 5-point Likert scale format. The scale ranges from 1 (Not Confident) to 5 (Extremely Confident). This scale has a standardised score ranging from 0 to 100, with a higher score indicating better self-efficacy.

The Multidimensional Scale of Social Support (MSPSS) measured perceived social support. Social support includes emotional support, belonging in a social community, being valued, practical help, and information and guidance (Drageset, 2021). It consists of 12 items grouped into three factors: family (items 3, 4, 8, and 11), friends (items 6, 7, 9, and 12), and other significant people (items 1, 2, 5, and 10) with scores from 1 (strongly disagree) to 7 (strongly agree). The total score ranges from 12 to 84, with a higher score indicating a higher level of perceived social support (Zimet et al., 1988).

The Patient Health Questionnaire Screener (PHQ-9) (Arroll et al., 2010) assessed patient depression levels. The questionnaire comprises 9 items (e.g., feeling down, sad or desperate/a), with scores ranging from 0 to 27. Each item is rated on a scale from 0 (never) to 3 (almost every day). Scores between 5 and 9 indicate mild depression. Scores >10 suggests a clinically significant level of depression.

The Mutuality Scale (MS) measured the quality of the relationship between the patient and the caregiver (e.g., how much does the person you assist help you?) (Archbold et al., 1990). The MS comprise 15 items rated on a 5-point Likert scale ranging from 0 (not at all) to 4 (much). The total scale score is obtained by averaging the scores of all the items. A higher score on the scale indicates a better relationship quality between the patient and the caregivers.

2.2.3. Data analysis

Analyses were carried out using Jeffreys's Amazing Statistics Program (Jasp®) V. 0.18. (JASP Team, 2023). The means, standard deviations, medians, and frequencies were used to describe the sociodemographic and clinical characteristics of the patients. The independent Bayesian T-test was used to compare the differences in the mean score of patient perception of patient-centredness, self-efficacy, depressive state and mutuality for men and women. The Cauchy prior

distribution (0.707), which implies that the alternative hypothesis and the null hypothesis equally explain the data, was employed. It is centred on 0 and has a scaling parameter of $1/\sqrt{2}$. A 50 % chance that the effect magnitude falls between -0.707 and 0.707 is indicated by the Cauchy prior (van Ravenzwaaij and Etz, 2021). For every *t*-test, bayes factor robustness tests were performed to investigate the impact of variance in the Cauchy prior on the Bayes factor. To identify the predictors of the three aspects of SC for men and women, two distinct Bayesian regression analyses were carried out. This approach was chosen because sex differences in oncology care are well documented, particularly concerning diagnosis, treatment, and survival (AIOM, 2023; Schmuck et al., 2020). The selection of variables to be included in the model was based on previous literature on SC in chronic illnesses according to which patient-centredness (Asmat et al., 2022), self-efficacy (Riegel et al., 2012; Riegel et al., 2021), social support (Ausili et al., 2018; Freedland et al., 2021), depressive state (Dickson et al., 2011; Egede et al., 2009; Freedland et al., 2021; Riegel et al., 2011), and mutuality (Hooker et al., 2018; Vellone et al., 2018) can influence the level of SC. Before observing the data, we assumed that all models were equally likely, therefore we applied a uniform prior for each model. The regression coefficients were subjected to a Jeffreys Zellner-Siow (JSZ) prior ($r = 0.354$). Each coefficient is given a normal distribution via the JSZ prior (Andraszewicz et al., 2015). Rather than comparing each model with the null model, the models produced for each domain were compared with the best model, as indicated by BF_{10} .

In our study, we adopted a Complete Case Analysis approach, excluding missing data from the analysis. Overall, complete cases considering all dependent and independent variables in the dataset were 214 for females and 217 for males. The analyses conducted indicate that the percentage of missing cases varies from a minimum of 12 % to a maximum of 18 %.

2.2.3.1. Ethical considerations. This study received approval from the Ethics Committee of the "Policlinico Tor Vergata" with reference number #188.22 before data collection. The study protocol was developed in accordance with the Good Clinical Practice Standards of the European Union and the Declaration of Helsinki.

All patients participated voluntarily and were informed about the study aims by research assistants. Patients provided an informed consent and a privacy statement before participation. Each patient was associated with an identification code to guarantee participant's data protection and anonymity.

3. Results

3.1. Demographic data

In total 518 enrolled patients with cancer receiving OAA treatment were enrolled. 49.22 % were men ($n = 255$) and 50.77 % were women ($n = 263$). The mean age for men was 62.45 ± 12.14 , and the mean age for women was 58.83 ± 13.37 years. The genitourinary cancer is the most frequent in men (50.58 %) while breast cancer is the most frequent in women (66.92 %) in the sample. The detailed demographic characteristics of men and women are provided in Table 1.

4. Sex-based mean differences in self-care dimensions

The mean SC maintenance score was 84.97 ± 11.68 for women and 85.88 ± 18.15 for men. The Bayes factor ($BF_{10} = 0.112$, error % = 0.154) indicated strong evidence for the null hypothesis, suggesting no meaningful difference between groups.

For SC monitoring, women scored 74.85 ± 21.36 and men 76.84 ± 25.90 . The Bayes factor ($BF_{10} = 0.268$, error % = 0.068) provided moderate evidence in favour of the null hypothesis, again supporting no sex-based differences.

Table 1
Socio-demographic and clinical characteristics.

| Variables | | Men (N = 255) | % | Missing | Women (N = 263) | % | Missing |
|-----------------------|----------------------------|-----------------|-------|---------|-----------------|-------|---------|
| Age | | 62.435 (12.143) | | | 58.83 (13.37) | | |
| | | Number | | | Number | | |
| Employment | Employed | 131 | 51.37 | 0 | 112 | 42.58 | 1 |
| | Not employed | 120 | 47.05 | | 120 | 57.03 | |
| Education | High school | 110 | 43.13 | 4 | 129 | 49.94 | 4 |
| | None or Eelementary | 27 | 10.58 | | 35 | 13.30 | |
| | University | 50 | 19.60 | | 44 | 16.73 | |
| | Secondary | 68 | 26.66 | | 51 | 19.39 | |
| Marital status | Divorced or separated | 9 | 3.52 | 0 | 24 | 9.12 | 1 |
| | Married | 196 | 76.86 | | 173 | 65.77 | |
| | Single | 23 | 9.02 | | 26 | 9.88 | |
| | Widowed | 27 | 10.58 | | 39 | 14.82 | |
| Income | Insufficient | 31 | 12.15 | 2 | 32 | 12.16 | 4 |
| | Sufficient | 105 | 41.17 | | 130 | 49.43 | |
| | Good or very good | 117 | 45.87 | | 97 | 36.88 | |
| Lives alone | No | 210 | 82.35 | 4 | 207 | 78.70 | 5 |
| | Yes | 41 | 16.07 | | 51 | 19.39 | |
| Tumor site | Breast | 1 | 0.39 | 1 | 176 | 66.92 | 8 |
| | Gastrointestinal | 41 | 16.07 | | 18 | 6.84 | |
| | Genitourinary | 129 | 50.58 | | 6 | 2.28 | |
| | Lung | 40 | 15.74 | | 27 | 10.23 | |
| | Other | 43 | 16.86 | | 36 | 13.68 | |
| Type of OAs | Citotoxic anticancer agent | 77 | 30.19 | 9 | 52 | 19.77 | 9 |
| | Hormonal therapy | 105 | 41.17 | | 34 | 12.92 | |
| | Tyrosin Kinase Inhibitor | 25.09 | 26.01 | | 168 | 63.87 | |
| Comorbidities | No | 0 | 0 | 50 | 5 | 1.90 | 61 |
| | One | 79 | 30.98 | | 74 | 28.13 | |
| | >Two | 126 | 49.41 | | 123 | 49.41 | |

In contrast, SC management showed a clear difference: women scored 69.79 ± 22.57 , while men scored 77.27 ± 24.48 . The Bayes factor ($BF_{10} = 13.690$, error % = 0.002) provided strong evidence for the alternative hypothesis, indicating significantly better SC management in men than in women (Tables 2 and 3). Robustness checks confirmed that these results remained stable across different prior specifications (Fig. 1).

4.1. Predictors of self-care among men

The self-care maintenance was predicted by depressive state, social support (received from others and family), mutuality, and self-efficacy explaining a large variance ($R^2 = 0.789$; $BF = 100.624$). The $BF_{inclusion}$ values of the variables provided strong evidence for inclusion in the model: depressive state ($BF_{inclusion}=59.353$), mutuality ($BF_{inclusion} =$

Table 3
Bayesian independent samples T-Test.

| | BF_{10} | error % |
|-----------------------|-----------|---------|
| Self-care maintenance | 0.112 | 0.154 |
| Self-care monitoring | 0.268 | 0.068 |
| Self-care management | 13.690 | 0.002 |

47.182) and self-efficacy ($BF_{inclusion} = 235743.858$). There is weak evidence for including social support received from other ($BF_{inclusion} = 2.536$) and social support received from family ($BF_{inclusion} = 3.527$) in the model.

Social support received from family and other, mutuality and self-efficacy predicted the self-care monitoring, explaining a moderate amount of variance ($R^2 = 0.635$; $BF = 62.950$). The $BF_{inclusion}$ values of

Table 2
Sex based comparison of descriptive statistics of predictors of SC.

| | SC Maintenance Scale | | | | SC Monitoring Scale | | | | SC Management Scale | | | |
|----------------------|----------------------|-----|--------|--------|---------------------|-----|--------|--------|---------------------|-----|--------|--------|
| | Group | N | Mean | SD | Group | N | Mean | SD | Group | N | Mean | SD |
| Phq9 | Male | 220 | 6.591 | 7.998 | Male | 223 | 6.619 | 8.014 | Male | 225 | 6.676 | 8.711 |
| | Female | 219 | 7.658 | 7.251 | Female | 220 | 7.673 | 7.249 | Female | 217 | 7.687 | 7.238 |
| Mspss tot | Male | 220 | 4.527 | 1.153 | Male | 223 | 4.533 | 1.157 | Male | 225 | 4.542 | 1.063 |
| | Female | 219 | 4.705 | 1.252 | Female | 220 | 4.693 | 1.253 | Female | 217 | 4.673 | 1.245 |
| Mspss family | Male | 220 | 6.524 | 1.108 | Male | 223 | 6.511 | 1.123 | Male | 225 | 6.503 | 0.976 |
| | Female | 219 | 6.113 | 1.221 | Female | 220 | 6.106 | 1.221 | Female | 217 | 6.107 | 1.227 |
| Mspss friends | Male | 220 | 4.372 | 1.922 | Male | 223 | 4.387 | 1.922 | Male | 225 | 4.391 | 1.766 |
| | Female | 219 | 4.193 | 2.072 | Female | 220 | 4.189 | 2.069 | Female | 217 | 4.149 | 2.058 |
| Mspss others | Male | 220 | 2.685 | 1.959 | Male | 223 | 2.701 | 1.954 | Male | 225 | 2.732 | 1.863 |
| | Female | 219 | 3.808 | 1.915 | Female | 220 | 3.785 | 1.924 | Female | 217 | 3.764 | 1.906 |
| Mutuality | Male | 220 | 3.451 | 0.763 | Male | 223 | 3.459 | 0.759 | Male | 225 | 3.450 | 0.752 |
| | Female | 219 | 3.363 | 0.769 | Female | 220 | 3.359 | 0.769 | Female | 217 | 3.357 | 0.773 |
| Pppc-R | Male | 220 | 1.973 | 1.111 | Male | 234 | 1.966 | 1.110 | Male | 225 | 1.971 | 1.107 |
| | Female | 219 | 2.148 | 1.108 | Female | 220 | 2.154 | 1.109 | Female | 217 | 2.150 | 1.114 |
| Self-efficacy | Male | 220 | 73.807 | 30.255 | Male | 223 | 73.812 | 30.151 | Male | 225 | 74.211 | 33.280 |
| | Female | 219 | 75.582 | 26.655 | Female | 220 | 75.455 | 26.627 | Female | 217 | 75.265 | 26.723 |

Note: mspss tot = Multidimensional Scale of Social Support total score; Phq9 = Patient Health Questionnaire Screener; Pppc-R = Patient Perception of Patient centredness Scale - revised version; SC = self-care.

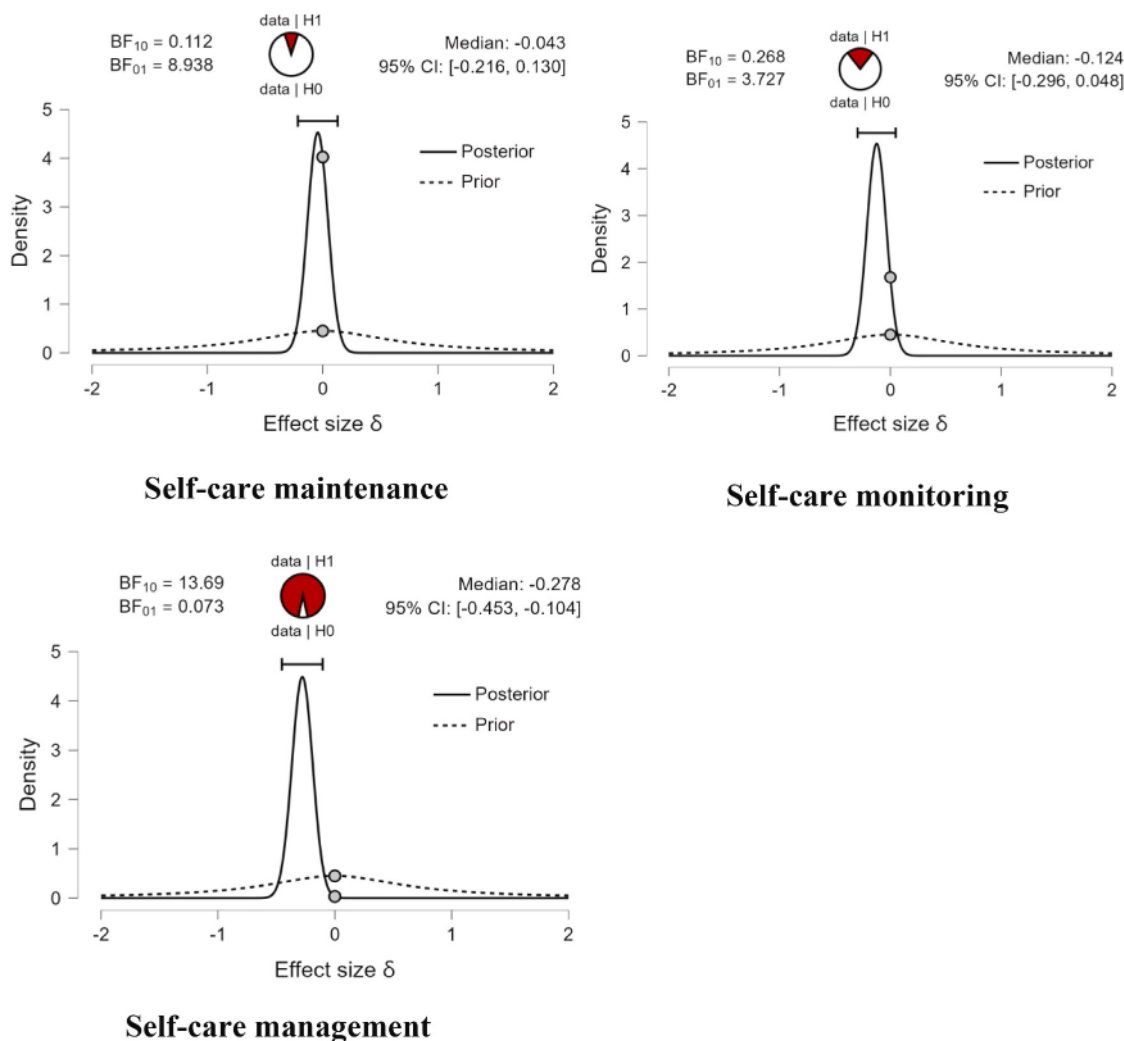


Fig. 1. Bayes factor robustness tests.

the variables provide strong evidence for inclusion in the model: mutuality ($BF_{inclusion} = 9.711$) and self-efficacy ($BF_{inclusion} = 1.050 \times 10^{+7}$). There is weak evidence for including social support received from family ($BF_{inclusion} = 4.172$) and social support received from others ($BF_{inclusion} = 4.167$) in the model.

The social support received from others, patient's perception of their centrality and self-efficacy, predicted the self-care management explaining a moderate variance ($R^2 = 0.596$; $BF = 81.816$). The $BF_{inclusion}$ values of the variables provide strong evidence for inclusion in the model: social support received from others ($BF_{inclusion} = 61.787$) and self-efficacy ($BF_{inclusion} = 140113.672$). There is weak evidence for including patient's perception of their centrality ($BF_{inclusion} = 1.480$) in the model.

The top five Bayesian regression models for each domain of the self-care (self-care maintenance, self-care monitoring, self-care management) for men are presented in Tables 4–6.

4.2. Predictors of self-care among women

The self-care maintenance in women was predicted by social support received by family and friends, patient's perception of their centrality, and self-efficacy, explaining a weak variance ($R^2 = 0.286$; $BF = 26.367$) of the SC maintenance score. The $BF_{inclusion}$ values of the variables provide strong evidence for inclusion in the model of self-efficacy ($BF_{inclusion} = 38.001$) and there is weak evidence for including social support received from family ($BF_{inclusion} = 2.723$), social support received

from friends ($BF_{inclusion} = 2.335$), and patient's perception of their centrality ($BF_{inclusion} = 2.677$).

The best model for the self-care monitoring in women included two predictors: patient's perception of their centrality, and self-efficacy, explaining a moderate variance ($R^2 = 0.309$; $BF = 32.610$) of the SC monitoring. The $BF_{inclusion}$ values of the variables provide strong evidence for inclusion in the model for both predictors: patient's perception of their centrality ($BF_{inclusion} = 16.129$), and self-efficacy ($BF_{inclusion} = 59982.573$).

The best model for self-care management score in women includes social support received from friends, mutuality, patient's perception of their centrality, and self-efficacy, explaining a moderate variance ($R^2 = 0.365$; $BF = 23.735$) of the SC management score. The $BF_{inclusion}$ values of the variables provide strong evidence for inclusion in the model of self-efficacy ($BF_{inclusion} = 1.309 \times 10^{+6}$), moderate evidence for social support received from friends ($BF_{inclusion} = 4.485$), and weak evidence for patient's perception of their centrality ($BF_{inclusion} = 1.187$). The top five Bayesian regression models for each domain of the self-care (self-care maintenance, self-care monitoring, self-care management) for women are presented in Tables 7–9.

5. Discussion

The aim of this study was to investigate the levels of SC maintenance, SC monitoring and SC management in Italian patients with cancer receiving OAA and to identify the predictor of SC. To our knowledge,

Table 4

Five best model for Bayesian regression for self-care maintenance domains in men.

| Models | P(M) | P (M data) | BF _M | BF ₁₀ | R ² |
|---|--------------|--------------|-----------------|------------------|----------------|
| phq9 + mspss family + mspss others + mutuality + self-efficacy | 0.004 | 0.283 | 100.624 | 1.000 | 0.789 |
| phq9 + mspss score + mspss friends + mutuality + self-efficacy | 0.004 | 0.091 | 25.400 | 0.320 | 0.787 |
| phq9 + mspss score + mspss family + mspss others + mutuality + self-efficacy | 0.004 | 0.088 | 24.609 | 0.311 | 0.792 |
| phq9 + mspss score + mspss family + mspss friends + mspss others + mutuality_pt + self-efficacy | 0.004 | 0.088 | 24.609 | 0.311 | 0.792 |
| phq9 + mspss family + mspss friends + mspss others + mutuality + self-efficacy | 0.004 | 0.088 | 24.609 | 0.311 | 0.792 |

Notes: mspss = Multidimensional Scale of Social Support; phq9 = Patient Health Questionnaire Screener; pppc-r = Patient Perception of Patient centredness Scale - revised version; SC = self-care. In Bayesian model comparison, the model with the highest P(M|data) and a BF₁₀ equal to 1 is considered the one with the strongest empirical support, and thus the “best” among the models. The other models, although not the most probable, are nonetheless included to allow for comparative evaluation: the procedure in fact involves testing a restricted set of alternative models (in this case five), to assess the robustness of the evidence and provide a more comprehensive basis for selecting the final model.

Table 5

Five best model for Bayesian regression for self-care monitoring domains in men Model.

| Models | P(M) | P (M data) | BF _M | BF ₁₀ | R ² |
|--|--------------|--------------|-----------------|------------------|----------------|
| Mspss family + mspss others + mutuality + self-efficacy | 0.004 | 0.198 | 62.950 | 1.000 | 0.635 |
| Mspss score + mspss family + mspss others + mutuality + self-efficacy | 0.004 | 0.089 | 24.776 | 0.447 | 0.640 |
| Mspss family + mspss friends + mspss others + mutuality + self-efficacy | 0.004 | 0.089 | 24.776 | 0.447 | 0.640 |
| Mspss score + mspss family + mspss friends + mspss others + mutuality pt + self-efficacy | 0.004 | 0.089 | 24.776 | 0.447 | 0.640 |
| Mspss score + mspss family + mspss friends + mutuality + self-efficacy | 0.004 | 0.089 | 24.776 | 0.447 | 0.640 |

Notes: mspss = Multidimensional Scale of Social Support; phq9 = Patient Health Questionnaire Screener; pppc-r = Patient Perception of Patient centredness Scale - revised version; SC = self-care. In Bayesian model comparison, the model with the highest P(M|data) and a BF₁₀ equal to 1 is considered the one with the strongest empirical support, and thus the “best” among the models. The other models, although not the most probable, are nonetheless included to allow for comparative evaluation: the procedure in fact involves testing a restricted set of alternative models (in this case five), to assess the robustness of the evidence and provide a more comprehensive basis for selecting the final model.

this is the first study to explore sex-based differences in SC among cancer patients treated with OAAs and to identify SC predictors separately for Italian men and women using Bayesian analysis. Understanding sex-related differences in self-care is essential for developing effective, person-centred interventions tailored to the needs of both male and female patients undergoing OAA treatment.

The results of our study provide important insights into sex differences in SC among cancer patients taking OAA and the predictive factors within the three dimensions of SC between men and women. Overall, no

Table 6

Five best model for Bayesian regression for self-care management domains in men Model.

| Models | P(M) | P (M data) | BF _M | BF ₁₀ | R ² |
|---|--------------|--------------|-----------------|------------------|----------------|
| Mspss others + pppc-r + self-efficacy | 0.004 | 0.243 | 81.816 | 1.000 | 0.596 |
| Mspss others + mutuality + self-efficacy | 0.004 | 0.142 | 42.179 | 0.584 | 0.594 |
| Mspss others + mutuality + pppc-r + self-efficacy | 0.004 | 0.089 | 24.941 | 0.367 | 0.601 |
| phq9 + mspss others + pppc-r + self-efficacy | 0.004 | 0.049 | 13.103 | 0.201 | 0.598 |
| Mspss friends + mspss others + pppc-r + self-efficacy | 0.004 | 0.041 | 10.925 | 0.169 | 0.598 |

Notes: mspss = Multidimensional Scale of Social Support; phq9 = Patient Health Questionnaire Screener; pppc-r = Patient Perception of Patient centredness Scale - revised version; SC = self-care. In Bayesian model comparison, the model with the highest P(M|data) and a BF₁₀ equal to 1 is considered the one with the strongest empirical support, and thus the “best” among the models. The other models, although not the most probable, are nonetheless included to allow for comparative evaluation: the procedure in fact involves testing a restricted set of alternative models (in this case five), to assess the robustness of the evidence and provide a more comprehensive basis for selecting the final model.

Table 7

Five best models for Bayesian regression for self-care maintenance domains in women.

| Models | P(M) | P (M data) | BF _M | BF ₁₀ | R ² |
|--|--------------|--------------|-----------------|------------------|----------------|
| Mspss family + mspss friends + pppc-r + self-efficacy | 0.004 | 0.094 | 26.367 | 1.000 | 0.286 |
| phq9 + mspss family + mspss friends + pppc-r + self-efficacy | 0.004 | 0.067 | 18.342 | 0.716 | 0.295 |
| Mspss score + mspss family + pppc-r + self-efficacy | 0.004 | 0.048 | 12.778 | 0.509 | 0.282 |
| phq9 + mspss score + mspss family + pppc-r + self-efficacy | 0.004 | 0.043 | 11.449 | 0.459 | 0.292 |
| Mspss family + mspss friends + self-efficacy | 0.004 | 0.035 | 9.364 | 0.378 | 0.268 |

Notes: mspss = Multidimensional Scale of Social Support; phq9 = Patient Health Questionnaire Screener; pppc-r = Patient Perception of Patient centredness Scale - revised version; SC = self-care. In Bayesian model comparison, the model with the highest P(M|data) and a BF₁₀ equal to 1 is considered the one with the strongest empirical support, and thus the “best” among the models. The other models, although not the most probable, are nonetheless included to allow for comparative evaluation: the procedure in fact involves testing a restricted set of alternative models (in this case five), to assess the robustness of the evidence and provide a more comprehensive basis for selecting the final model.

significant differences emerged in the SC maintenance and monitoring scores between men and women, while significant differences were observed in SC management scores. Specifically, the t-test from the Bayesian analyses demonstrated that for SC maintenance and SC monitoring, sex differences in these two dimensions were not significant. However, regarding SC management, the results suggested that men have significantly higher scores compared to women in this dimension. These findings indicate that while men and women employ similar strategies for maintaining and monitoring SC, men tend to manage SC more effectively than women. A possible explanation for these results may be related to the fact that, according to the Italian National Institute of Health, nearly 80 % of family caregivers assisting people with chronic diseases are women (Istituto Superiore di Sanità, 2024). Female caregivers are predominantly spouses who are actively involved in supporting their male partners in daily activities and promoting a healthy lifestyle. Consequently, men receive significant

Table 8

Five best models for Bayesian regression for self-care monitoring domains in women.

| Models | P(M) | P (M data) | BF _M | BF ₁₀ | R ² |
|--|--------------|--------------|-----------------|------------------|----------------|
| Pppc-r + self-efficacy | 0.004 | 0.113 | 32.610 | 1.000 | 0.309 |
| Mspss others + pppc-r + self-efficacy | 0.004 | 0.091 | 25.619 | 0.805 | 0.320 |
| Mspss friends + pppc-r + self-efficacy | 0.004 | 0.065 | 17.591 | 0.569 | 0.318 |
| Mspss family + pppc-r + self-efficacy | 0.004 | 0.063 | 17.229 | 0.558 | 0.318 |
| mutuality + pppc-r + self-efficacy | 0.004 | 0.055 | 14.758 | 0.483 | 0.317 |

Notes: mspss = Multidimensional Scale of Social Support; phq9 = Patient Health Questionnaire Screener; pppc-r = Patient Perception of Patient centredness Scale - revised version; SC = self-care.

In Bayesian model comparison, the model with the highest P(M|data) and a BF₁₀ equal to 1 is considered the one with the strongest empirical support, and thus the “best” among the models. The other models, although not the most probable, are nonetheless included to allow for comparative evaluation: the procedure in fact involves testing a restricted set of alternative models (in this case five), to assess the robustness of the evidence and provide a more comprehensive basis for selecting the final model.

Table 9

Five best models for Bayesian regression for self-care management domains in women.

| Models | P(M) | P (M data) | BF _M | BF ₁₀ | R ² |
|---|--------------|--------------|-----------------|------------------|----------------|
| Mspss friends + mutuality + pppc-r + self-efficacy | 0.004 | 0.085 | 23.735 | 1.000 | 0.365 |
| Mspss friends + mutuality + self-efficacy | 0.004 | 0.076 | 20.960 | 0.892 | 0.353 |
| Mspss family + mspss friends + pppc_score + self_efficacy | 0.004 | 0.072 | 19.843 | 0.848 | 0.364 |
| Mspss friends + pppc_r + self-efficacy | 0.004 | 0.068 | 18.617 | 0.799 | 0.352 |
| Mspss family + mspss friends + self-efficacy | 0.004 | 0.067 | 18.213 | 0.783 | 0.352 |

Notes: mspss = Multidimensional Scale of Social Support; phq9 = Patient Health Questionnaire Screener; pppc_r = Patient Perception of Patient centredness Scale - revised version; SC = self-care.

In Bayesian model comparison, the model with the highest P(M|data) and a BF₁₀ equal to 1 is considered the one with the strongest empirical support, and thus the “best” among the models. The other models, although not the most probable, are nonetheless included to allow for comparative evaluation: the procedure in fact involves testing a restricted set of alternative models (in this case five), to assess the robustness of the evidence and provide a more comprehensive basis for selecting the final model.

support from caregivers, which could facilitate adequate management of SC behaviours.

The analysis of SC predictors highlighted significant differences between men and women. Regarding men, the SC maintenance was associated with self-efficacy, depressive state, mutuality and social support (received from family). SC monitoring was associated with self-efficacy and mutuality played a significant role, confirming that men with greater confidence in their abilities are more careful to their health. Lastly, SC management was associated with self-efficacy, social support, and the perception of centrality, with the first two factors serving as key predictors. In women, SC maintenance was associated with social support (family and friends), perception of centrality, and self-efficacy, although the impact was smaller than in men. Again, self-efficacy was the strongest predictor, while social support and centrality played a marginal role. SC monitoring in women, however, was associated with perception of centrality and self-efficacy. Finally, SC management was associated with social support (friends), mutuality, perception of

centrality, and self-efficacy. Once again, self-efficacy emerged as the primary predictor, while the other factors had a lesser impact.

In both sexes, self-efficacy was associated with all dimensions of SC, confirming its importance as previously demonstrated in patients with chronic conditions (Juarez et al., 2021; Maeda et al., 2013; Tan et al., 2021; Yu et al., 2021). Furthermore, the study by Caruso et al. on SC in adult patients with type 2 diabetes mellitus demonstrated that higher SC confidence was significantly associated with better SC in both men and women (Caruso et al., 2020). In cancer patients undergoing OAAs, self-efficacy can influence the SC, improving adherence to treatments, the adoption of healthy behaviours, and the ability to cope with challenges, ultimately having a positive impact on quality of life. Moreover, it has been demonstrated that self-efficacy acts as a positive mediator between family support and each dimension of SC (Iovino et al., 2023).

The analyses also revealed that the perception of centrality is a key factor in predicting SC in women, while in men it only affects the dimension of SC management. The role of perceived centrality as a predictive factor has not been taken into consideration in other studies so far. This difference may stem from the fact that women tend to be more proactive in seeking information about their condition, consulting healthcare professionals more frequently, and quest social support compared to men, thus perceiving higher perception of their centrality in the care trajectory (Stuckey et al., 2014). These findings underscore the importance of understanding how patients perceive their role in the care trajectory. Regardless of sex, acknowledging patients' individual experiences and perceptions is essential for delivering truly person-centred care. A personalized approach not only respects individual differences but also contributes to greater patient satisfaction, improved adherence to treatment, and better clinical outcomes (Nguyen et al., 2020).

Regarding social support, it was associated with all SC scales in both men and women with cancer undergoing OAAs, excluding self-care monitoring scale in women. In this study, however, social support had a greater impact on men's SC compared to women's SC. One possible explanation is that women may less frequently have a reliable person to talk to or assist them with daily activities, whereas men may perceive greater support from family members who actively help them in their SC. Nevertheless, social support remains a key component in the overall SC process. It has already been demonstrated that in chronic diseases, social support plays a crucial role in enhancing SC (Fivecoat et al., 2018; Gallagher et al., 2011). Generally, family is the primary source of social support in chronic diseases (Hu et al., 2015; Lee et al., 2017). Patients with strong social support tend to consult healthcare professionals more frequently upon the onset of symptoms, adhere better to treatments, and consequently improve their health status. An innovative aspect of this study regards the way social support was analysed. Unlike other studies conducted in similar populations (Fivecoat et al., 2018; Gallagher et al., 2011), in this study the individual dimensions (family, friends, others) were considered separately as predictors of self-care behaviours. This choice highlighted novel sex differences. For example, for self-care maintenance, support from family and others was found to be significant for men, while support from family and friends was found to be significant for women. A possible explanation could be that men tend to rely on family as the primary source of practical and emotional support, while women also rely more on established friendship networks. Similarly, for self-care monitoring and self-care management, distinct patterns emerged between men and women, suggesting different ways of using relational resources. To our knowledge, no previous studies have characterised the role of social support by distinguishing between men and women in this context, so this is a novel and relevant finding in the literature.

Additionally, social support can affect self-efficacy in SC, confidence in one's capacity to care for one self, and ultimately the SC process itself, in accordance with the middle-range theory of SC in chronic illness (Riegel et al., 2012). A study has shown that women are more likely than men to manage symptoms independently and tend to develop stronger

SC maintenance abilities (Stamp, 2014).

A significant association of depression and SC maintenance was found in men alone, where a lower depressive level is associated with better SC behaviour. Several studies have demonstrated that depression acts as a barrier to SC and can interfere with treatment adherence, lifestyle modifications, and patient confidence (Freedland et al., 2021). Contrary to the data provided in the literature, in our study lower depression was associated with adequate SC maintenance in men. Researchers had expected this result in women, as it has been demonstrated that women exhibit more depressive symptoms than men (Kockler and Heun, 2002). Another study also found that men are 63 % less likely to develop depression than women (Abate, 2013). The study by Iovino et al. also confirmed the negative relationship between depression and SC (Iovino et al., 2023). Similarly, Iovino et al. found that depression was negatively associated with SC maintenance in elderly patients with multiple chronic conditions (Iovino et al., 2020). A study conducted on South Asian individuals with chronic obstructive pulmonary disease also found that women exhibited higher levels of depression compared to men (Younas et al., 2024).

Mutuality, as the quality of the relationship between the patient and the caregiver, emerged in our study as a relevant factor in SC maintenance and SC monitoring for men, and in the SC management for women. To our knowledge, no previous study has specifically explored the relationship between mutuality and SC monitoring, although it is known that positive interactions with caregivers can enhance patients' self-observation and decision-making abilities (Hooker et al., 2018; Vellone et al., 2018). In patients with heart failure, mutuality has been found to predict both physical and mental quality of life within the patient-caregiver dyad, suggesting that a supportive relationship with a partner or social network can act as a catalyst for more effective SC behaviours (Vellone et al., 2018). Furthermore, positive interactions with healthcare providers have been shown to improve patients' ability to monitor symptoms and make informed decisions (Cilluffo et al., 2024). These findings highlight how confidence in one's abilities is a key element in SC, with a particularly strong influence in men. Meanwhile, in women, social support and the perception of their own centrality play a role, although a less determining one.

5.1. Limitations

This study has some limitations that should be considered. First, the reference population is exclusively Italian, which limits the generalizability of the findings to broader populations. Cultural, social, and healthcare system differences may influence SC behaviours, making it necessary to validate these results in other contexts. Secondly, the percentage of missing data exceeds 10 %, which could introduce potential biases in the analysis. Although appropriate statistical methods were applied to manage missing data, this limitation should be considered when interpreting the results. Future research should aim to include more diverse populations and ensure more comprehensive data collection to strengthen the robustness of the findings. Another limitation of this study is that potential differences in cancer diagnosis and treatment modalities between men and women, which could influence self-care behaviours, were not systematically considered. Future research should take these sex-related differences into account.

5.2. Implications for clinical practice

These findings suggest that clinical practice should adopt a more personalized approach to patient education, integrating a sex-sensitive perspective. Tailored interventions that address sex-specific needs may help strengthen self-efficacy, promote appropriate coping strategies, and foster greater engagement in disease management. Considering psychosocial and cultural dimensions, as well as the role of social support, could further enhance the effectiveness of self-care interventions and improve the appropriateness of care delivery, with a potential impact on

a better disease trajectory.

6. Conclusions

These results suggest that self-care management differs by sex, which may be relevant when considering tailored interventions. These differences, influenced by biological, psychological, and socio-cultural factors, can have important implications for clinical practice, as men and women adopt different SC strategies for their conditions. A more personalized approach in the education delivered by healthcare professionals, considering sex-specific needs, may support improvements in patients' self-care behaviors. For example, targeted health education programs could encourage greater male involvement in chronic disease management and promote more effective coping strategies for women. Integrating a sex perspective into clinical practice could significantly contribute to health promotion by improving the appropriateness of care, ultimately benefiting both patients and the sustainability of the national healthcare system. Having access to this information would enable healthcare professionals to better identify patients at risk of poor SC and to develop more effective educational interventions tailored to sex differences. Furthermore, these findings underscore the importance of strategies aimed at strengthening self-efficacy in SC pathways, optimizing health support based on sex-specific needs. Future research should further explore the role of sociodemographic, psychosocial, and cultural factors to refine personalized interventions and reduce sex differences in clinical outcomes.

CRedit authorship contribution statement

Silvia Ucciero: Writing – original draft, Methodology. **Ahtisham Younas:** Writing – original draft, Formal analysis. **Francesco Torino:** Writing – review & editing, Supervision. **Angela Durante:** Writing – review & editing, Supervision. **Federica Lacarbonara:** Writing – review & editing. **Tatiana Bolgeo:** Writing – review & editing. **Vincenzo Damico:** Writing – review & editing. **Greta Ghizzardì:** Writing – review & editing. **Sipontina Rita Zerulo:** Writing – review & editing. **Rosaria Alvaro:** Supervision. **Ercole Vellone:** Writing – review & editing, Supervision, Conceptualization. **Marco Di Nitto:** Writing – original draft, Investigation, Formal analysis, Data curation, Conceptualization.

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Declaration of competing 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.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ejon.2025.103019>.

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