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Development and Psychometric Validation of the Self-Care of Cancer Inventory (SC-CI)

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ABSTRACT

Aim: To develop a generic instrument for measuring self-care behaviours in adults with cancer and to evaluate its initial psychometric properties.

Design: A psychometric validation study was conducted within the ONCO-SHIELD longitudinal observational study at Careggi University Hospital (Florence, Italy) enrolling adult patients with metastatic solid tumours receiving first-line systemic anticancer therapy and an ECOG Performance Status of 0–2.

Methods: The SC-CI was developed through a theory-driven process including item generation, expert validation, and cognitive interviews, and subsequently evaluated using confirmatory factor analysis, McDonald's omega, test–retest reliability, item response theory, differential item functioning, and convergent validity analyses.

Results: A total of 305 patients were included (mean age 68.4 years, 68.2% male), mainly with lung (28.2%), lower gastrointestinal (23.3%), and genitourinary cancers (22.0%). Content validity was excellent across domains. Confirmatory factor analysis supported the multidimensional structure of the instrument, with acceptable-to-good fit after minor item refinement. Internal consistency was adequate to good ($\omega = 0.74$ – 0.85), and test–retest reliability was satisfactory ($ICC = 0.70$ – 0.74). Convergent validity was supported by positive correlations with health literacy and by associations of monitoring and management with doctors' health locus of control. Differential item functioning by sex and age was limited and showed negligible practical impact.

Conclusion: The SC-CI provides promising initial psychometric evidence as a multidimensional, theory-based tool for assessing self-care in patients with metastatic solid tumours receiving systemic anticancer therapy.

Implications for the Profession and/or Patient Care: SC-CI may support nursing practice by helping identify patients with unmet self-care needs and guide tailored educational and symptom-management interventions in this population. Further validation in independent and more diverse oncology populations is warranted before broader clinical application.

Patient or Public Contribution: Patients contributed to SC-CI development through cognitive interviews assessing item relevance, comprehensibility, and comprehensiveness, informing refinement before psychometric testing.

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What Does This Paper Contribute to the Wider Global Clinical Community?

- The SC-CI was theory-based and grounded in the Middle-Range Theory of Self-Care of Chronic Illness, extending its application to oncology care.
- The instrument demonstrated satisfactory psychometric properties, including structural validity, internal consistency, test-retest reliability, and convergent validity.
- The SC-CI may support oncology nursing practice by identifying unmet self-care needs and guiding personalized educational and symptom-management interventions across diverse cancer populations.

1 | Background

Cancer represents a major global health burden, with an estimated 20.0 million new cases and 9.7 million deaths worldwide (Bray et al. 2024). In the European Union, approximately 2.7 million new cancer cases and 1.3 million deaths were estimated (Dyba et al. 2021), whereas in Italy 362.100 new malignant neoplasms were diagnosed in 2025 and nearly 3.7 million people were living after a cancer diagnosis (Fabiano et al. 2026; Tripi et al. 2025), highlighting the increasing need for long-term oncology and survivorship care. As a consequence, cancer is increasingly managed as a chronic condition, requiring patients to actively engage in their own care across the different phases of the disease trajectory (Hove et al. 2025). In this context, self-care has emerged as a fundamental component of oncology care.

The Middle-Range Theory of Self-Care of Chronic Illness conceptualizes self-care as a dynamic and multidimensional process through which individuals engage in specific behaviours to maintain physical and emotional stability (self-care maintenance), monitor for changes in signs and symptoms (self-care monitoring), and respond appropriately when symptoms occur (self-care management). This framework provides a robust theoretical basis for understanding how patients actively contribute to managing chronic conditions, including cancer (Riegel et al. 2012).

Patients receiving systemic anticancer therapy must adhere to complex treatment regimens, monitor treatment-related symptoms, and make timely decisions regarding symptom management and healthcare utilization, often outside healthcare settings (Grusdat et al. 2022; Herrmann et al. 2019; Hoang et al. 2024; Hsu et al. 2025; Lu et al. 2024). Effective self-care has been associated with improved symptom control, better treatment adherence, enhanced quality of life, and more efficient healthcare utilization (Rimmer et al. 2023; Wang et al. 2023). However, patients' ability to perform these behaviours varies considerably and may be compromised by symptom burden, limited knowledge, inadequate support, and unmet supportive care needs (Lu et al. 2026; Magalhães et al. 2020), highlighting the need for valid instruments capable of comprehensively assessing self-care.

Despite the growing recognition of its importance, the assessment of self-care in oncology remains limited. Existing instruments have primarily focused on the self-management of individual symptoms or treatment-specific behaviours, rather than the broader multidimensional construct of self-care. A recent COSMIN-based systematic review confirmed that most available instruments are not theory-driven and have only limited evidence supporting their measurement properties (Amato et al. 2026). More recently, theory-based instruments have been developed, but these are restricted to specific clinical contexts, such as patients receiving oral anticancer therapies (Di Nitto, Ucciero, et al. 2025). Conversely, generic self-care instruments derived from chronic illness frameworks have been applied in oncology but lack cancer-specific content, limiting their ability to capture essential behaviours such as managing treatment toxicities, monitoring therapy-related symptoms, and making decisions in response to rapidly changing clinical conditions (Di Nitto, Durante, et al. 2025). Consequently, no currently available instrument provides a comprehensive, theory-based assessment of self-care that is specifically designed for adult oncology populations across the broad spectrum of self-care maintenance, monitoring, and management.

Therefore, this study aimed to develop the Self-Care of Cancer Inventory (SC-CI), a theory-based instrument specifically designed to comprehensively assess self-care maintenance, monitoring, and management in adult patients with cancer, and to evaluate its psychometric properties in a sample of patients with metastatic solid tumours receiving first-line systemic anticancer therapy.

2 | Methods

2.1 | Study Design

This is a psychometric validation study conducted as part of a larger longitudinal observational study focused on self-care behaviours in patients with cancer (ONCOSHIELD). Data for the validation phase were collected from July 2025 to January 2026. The study was structured into three main phases, including conceptual development and item generation, assessment of content validity, and evaluation of psychometric properties.

2.2 | Participants and Data Collection

Adult patients with cancer admitted to Careggi University Hospital (Florence, Italy) were eligible if they had an Eastern Cooperative Oncology Group Performance Status (ECOG PS) between 0 and 2 indicating that they were fully active, restricted only in physically strenuous activity, or ambulatory and capable of all activities related to personal care but unable to carry out work activities (Sørensen et al. 1993) and were undergoing first-line systemic anticancer therapy for metastatic solid tumours, namely lung cancer, gastrointestinal malignancies (including oesophageal, gastric, colorectal, pancreatic, and hepatocellular cancers), and urinary tract cancers (including renal and bladder cancers). Exclusion

criteria were inability to speak or write in Italian and an estimated life expectancy of less than 6 months. Clinical and demographic characteristics were collected from medical records. Study data were recorded and managed electronically using Research Electronic Data Capture (REDCap; Harris et al. 2019), a secure web-based platform for data collection. Questionnaires were administered by trained nurses after obtaining written informed consent. Nurses explained the study purpose, provided standardized instructions for completion, and remained available to clarify procedural questions without influencing patients' responses. The questionnaires required approximately 30 min to complete and were filled in before or during treatment sessions, in a setting designed to ensure patient privacy and confidentiality.

2.3 | Instruments

2.3.1 | Self-Care of Cancer Index Inventory (SC-CI) Development

The development of the SC-CI questionnaire was theory-driven and grounded in the Middle-Range Theory of Self-Care of Chronic Illness (Riegel et al. 2012). This theory posits that self-care is composed of the three interrelated dimensions of self-care maintenance, self-care monitoring, and self-care management. Item generation was based on the available literature, qualitative evidence, and relevant clinical recommendations, and the preliminary item pool was organized according to these three domains of the theory. Subsequently, the draft instrument underwent qualitative evaluation by a panel of clinical experts to assess the comprehensiveness, comprehensibility, and relevance of the items. In the final content validity phase, a larger panel of clinical experts rated the relevance of each item on a 4-point scale ranging from 1 (*totally irrelevant*) to 4 (*totally relevant*), with responses then dichotomized into irrelevant (scores 1–2 = 0) versus relevant (scores 3–4 = 1). Item relevance was quantified using the Item-Level Content Validity Index (I-CVI), calculated as the proportion of experts rating each item as relevant, whereas overall scale content validity was assessed using the Scale-Level Content Validity Index based on the average method (S-CVI/Ave), obtained by averaging the I-CVI values across items. In line with established criteria, I-CVI values > 0.78 were considered excellent, values between 0.70 and 0.78 indicated that an item required revision, and values < 0.70 suggested item deletion; for the overall scale, an S-CVI/Ave > 0.90 was considered indicative of excellent content validity (Lynn 1986; Polit and Beck 2004). As a final step, cognitive interviews with patients were conducted using the think-aloud technique (Willis 2005) to further refine item wording and assess the extent of clarity and comprehensibility of each item.

The final version of the instrument consisted of 38 items distributed across the three dimensions of self-care: 18 items assessing self-care maintenance, 8 items assessing self-care monitoring, and 12 items assessing self-care management. Items 2 and 3, originally included in the self-care maintenance domain, were excluded from the final measurement model because of their inadequate psychometric performance and are therefore not included in score calculation. Nevertheless, given

their potential clinical relevance, these items may be collected separately as supplementary clinical indicators to provide additional information on patients' self-care behaviours. All scored items were rated using a 5-point Likert scale. Response options for the self-care maintenance and self-care monitoring scales ranged from 1 (*Never*) to 5 (*Always*), whereas the self-care management scale ranged from 1 (*Not at all likely*) to 5 (*Totally likely*). Scores for each scale were standardized to a 0–100 metric by summing the item scores, subtracting the minimum possible raw score for that scale, dividing the result by the corresponding possible score range, and multiplying by 100. This rating scale and scoring procedure are consistent with those adopted in other validated self-care instruments based on the middle-range theory of self-care of chronic illness, thereby supporting comparability across self-care measures (Di Nitto, Ucciero, et al. 2025; Riegel et al. 2018). Higher scores indicated higher levels of self-care.

2.3.2 | European Health Literacy Survey Questionnaire (HLS-EU-Q16)

The HLS-EU-Q16 was administered to assess convergent validity, as previous evidence indicates that higher health literacy is associated with better self-care behaviours in chronic illness (van der Gaag et al. 2022) and more favourable self-management-related outcomes in oncology populations (Clarke et al. 2021; Papadakos et al. 2018). Accordingly, we hypothesized a positive association between health literacy and self-care scores.

The HLS-EU-Q16 measures perceived difficulty in accessing, understanding, appraising, and applying health information. Items are rated on a four-point Likert scale from 1 (*very difficult*) to 4 (*very easy*) and, according to the standard scoring procedure, are dichotomized into *difficult* (0) and *easy* (1), yielding a total score ranging from 0 to 16, with higher scores indicating better health literacy. The Italian version has demonstrated acceptable reliability and validity, and adequate internal consistency was observed in the present sample (ordinal McDonald's $\omega = 0.79$; Lorini et al. 2019).

2.3.3 | Multidimensional Health Locus of Control-Form C (MHLC-C)

The MHLC-C is an 18-item, condition-specific measure of health locus of control, with items rated on a 6-point Likert scale from 1 (*strongly disagree*) to 6 (*strongly agree*). It includes four subscales: Internality and Chance, each comprising six items and scored from 6 to 36, and Doctors and Other People, each comprising three items and scored from 3 to 18. Higher scores indicate stronger endorsement of the corresponding locus of control dimension. Previous studies in chronic-disease samples have reported satisfactory internal consistency for all subscales (Ubbiali et al. 2008; Wallston et al. 1994).

The MHLC-C was administered to assess convergent validity. Although internal health locus of control has generally been associated with greater engagement in health-related behaviours and treatment adherence (Náfrádi et al. 2017),

evidence from oncology suggests that perceived control may be more strongly oriented toward external agents, particularly physicians, due to the complexity of the disease trajectory and the central role of oncologists in treatment decision-making (Dopelt et al. 2022; Hillen et al. 2011). Accordingly, we hypothesized that self-care scores would be more strongly and positively associated with the Doctors dimension than with Internality, whereas weaker or negative associations were expected for Chance.

2.3.4 | Sociodemographic and Clinical Questionnaire

Sociodemographic and clinical data were collected through a specific questionnaire developed by the research team for the purposes of this study. The instrument included items on sex, age, living arrangement, educational level, smoking status, alcohol consumption, cancer and systemic treatment type. Before the start of data collection, the questionnaire was examined by the interviewers to evaluate its face validity and to ensure that all items were clear, relevant, and appropriate.

2.4 | Ethical Considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki (Kurihara et al. 2024) and received approval from the local Independent Ethics Committee of the “Area Vasta Toscana Centro” (CEAVC 27923) of the Tuscany region (Italy). Written informed consent was obtained from all participants prior to enrolment. Data were pseudo-anonymized using sequential numeric codes, and re-identification was allowed only to the principal investigator for the management of missing or incomplete data.

2.5 | Sample Size Calculation

Sample size was calculated within the framework of the ONCOSHIELD longitudinal study, assuming self-care as the primary outcome. A sample of 277 participants provides 80% power, with a 5% alpha error, to detect a prevalence of 45% of inadequate self-care among oncology patients (AL-Harithy and Wazqar 2021; Hong et al. 2022; Shaban 2023). Assuming a 10% dropout rate, the final required sample size was 305 participants. No separate a priori sample size calculation was performed specifically for the present psychometric analyses. Nevertheless, the overall sample size was compatible with commonly used recommendations for confirmatory factor analysis (CFA), because the three SC-CI domains were analysed separately rather than as a single 40-item scale (Boateng et al. 2018). No specific sample size assessment was performed for the DIF, test-retest, or IRT analyses; consequently, these analyses should be regarded as preliminary.

2.6 | Statistical Analysis

Descriptive statistics were computed to characterize the sample. Continuous variables were summarized as means and

standard deviations, and categorical variables as frequencies and percentages. Item distributions were inspected to evaluate response patterns, floor and ceiling effects, and sparse categories. Polychoric item-total correlations were calculated within each domain, with values ≥ 0.30 considered acceptable (Streiner et al. 2014). The factorial structure of the Self-Care of Cancer Inventory domains (maintenance, monitoring, and management) was evaluated using CFA with robust weighted least squares estimation (WLSMV), appropriate for ordinal indicators. Model specification followed the Middle-Range Theory of Self-Care of Chronic Illness (Riegel et al. 2012) and was refined conservatively based on conceptual coherence and psychometric diagnostics. Model fit was evaluated using χ^2 test of model fit, Root Mean Square Error of Approximation (RMSEA) with 90% confidence interval, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Standardized Root Mean Square Residual (SRMR). Acceptable model fit was defined as $\text{RMSEA} \leq 0.08$, CFI and TLI ≥ 0.90 (≥ 0.95 indicating excellent fit), and $\text{SRMR} \leq 0.08$, consistent with established recommendations for structural equation modelling (Hu and Bentler 1999). Internal consistency was evaluated using McDonald's omega coefficients derived from polychoric correlations (Dunn et al. 2014). Construct replicability was evaluated using Hancock's *H* index (Hancock and Mueller 2001), which estimates the degree to which a latent variable is well defined by its indicators and likely to be stable across samples. Values ≥ 0.70 were interpreted as indicating adequate construct replicability, whereas values ≥ 0.80 suggested a well-defined latent construct (Hancock and Mueller 2001). Test-retest reliability was evaluated in a subsample of 50 participants who completed the instrument twice over a 2-week interval using two-way mixed-effects intraclass correlation coefficients (ICC) with absolute agreement definition (ICC-A), interpreted according to established thresholds (≥ 0.50 moderate; ≥ 0.75 good; ≥ 0.90 excellent; Koo and Li 2016). The 2-week interval was selected to minimize the likelihood of substantial true change while reducing recall effects. Clinical stability between assessments was not formally evaluated. To further examine item-level performance and information precision, Item Response Theory (IRT) analyses were conducted separately for each domain using a graded response model (GRM) (Samejima 2016). Item discrimination (a parameters), category thresholds (b parameters), and item and test information functions were estimated. Items with low discrimination, poorly ordered thresholds, or limited information contribution were scrutinized in conjunction with CFA results. Measurement invariance at the item level was examined through differential item functioning (DIF) analyses within the IRT framework (Crane et al. 2006). Multi-group GRM models were estimated to test both uniform (threshold) and non-uniform (discrimination) DIF across sex and age groups. Likelihood-ratio procedures were applied, and *p*-values were adjusted for multiple testing using the false discovery rate (FDR) approach. For items showing statistically significant DIF, category response curves were visually inspected to evaluate the magnitude and practical relevance of parameter differences. Convergent validity was examined through correlations with theoretically related constructs (e.g., health literacy and health locus of control). Known-groups validity was tested by comparing self-care scores across predefined subgroups using independent-samples *t*-tests and correlations

for continuous covariates. Statistical significance was set at $p < 0.05$. All CFA and IRT analyses were performed in Mplus v8.9 (Muthén and Muthén 2007); descriptive and validity analyses were conducted using IBM SPSS v27 (George and Mallery 2022).

3 | Results

3.1 | Sample Characteristics

The study included 305 patients (Table 1). Overall, the sample was predominantly composed of older adults (mean age 68.44 years, SD = 9.53), with a higher proportion of male participants. Most patients were married or cohabiting, although a substantial subgroup reported living alone. Educational attainment was generally low. The sample included patients with heterogeneous cancer diagnoses, mainly lung, lower gastrointestinal, and genitourinary cancers. Functional status was largely preserved (ECOG PS 0–1: 96.8%).

3.2 | Content Validity

The initial item pool was developed through a theory-informed, evidence-based process that drew on a review of available instruments, quantitative and qualitative studies on self-care behaviours in oncology populations, and relevant clinical guidelines and protocols. This phase was coordinated by an international research group comprising two expert oncology nurses and two nurses with longstanding expertise in self-care. The first version of the instrument, consisting of 39 items, was subsequently evaluated by a multidisciplinary panel of 20 experts through an online survey assessing relevance, comprehensibility, and comprehensiveness. The characteristics of the experts involved are reported in Table S1. Overall, this version demonstrated satisfactory content validity (S-CVI: self-care maintenance = 0.97, self-care monitoring = 0.98, self-care management = 0.97; Table S3), with only minor wording revisions required to improve item comprehensibility, for example, by replacing less familiar terms with more patient-friendly language and making the intended behaviour or symptom reference more explicit, particularly for items 1–13, 17, 18, 21, 22, 23, 26, 27, 29, and 30. In terms of comprehensiveness, the panel recommended the addition of one item addressing the rest/sleep component within the self-care maintenance domain. The resulting 40-item version (Version 2, Tables S8–S10) was then resubmitted to the same panel and showed excellent content validity at both the item and scale levels (S-CVI: self-care maintenance = 0.97, self-care monitoring = 0.98, self-care management = 0.97; Table S4). No items were removed during this phase, and the newly added item was also positively evaluated. Finally, cognitive interviews were conducted with ten patients whose demographic and clinical characteristics are presented in Table S2. Participants judged the instrument to be relevant, comprehensible, and comprehensive; accordingly, no further modifications were deemed necessary.

TABLE 1 | Sociodemographic and clinical characteristics of the study sample ($N = 305$).

Variable	Category	N or mean	% or SD
Age	Years	68.44	9.53
Sex	Male	208	68.2
	Female	97	31.8
Marital status	Single	28	9.2
	Married/cohabiting	220	72.1
	Divorced/separated	27	8.9
	Widowed	30	9.8
Living alone	No	236	77.4
	Yes	69	22.6
Number of cohabitants (among those not living alone)	1 person	197	83.5
	2 persons	29	12.3
	≥ 3 persons	10	4.2
Education	No formal education	3	1.0
	Primary school	150	49.2
	Lower secondary school	104	34.1
	Upper secondary school	48	15.7
Smoking status	Never	91	29.9
	Current smoker	67	22.0
	Former smoker	146	48.0
Alcohol consumption	Never	100	32.9
	< 1/month	46	15.1
	2–4/month	42	13.8
	2–3/week	10	3.3
	> 4/week	10	3.3
Cancer type	Former drinker	96	31.6
	Lung	86	28.2
	Upper GI	29	9.5
	Lower GI	71	23.3
	Pancreas	27	8.9
	Hepatocellular carcinoma	18	5.9
	Biliary tract	7	2.3
	Genitourinary	67	22.0

(Continues)

TABLE 1 | (Continued)

Variable	Category	N or mean	% or SD
Therapy	Chemotherapy	56	18.4
	Immunotherapy	67	22.0
	Chemo-immunotherapy	65	21.3
	Chemo + targeted therapy	67	22.0
	Immunotherapy + targeted therapy	50	16.4
ECOG performance status	Fully active	164	53.8
	Restricted in physically strenuous activity	131	43.0
	Ambulatory and capable of self-care but unable to work	10	3.30

3.3 | Item Descriptive Statistics

Missing data were minimal (0.3%–2.0% per item) and evenly distributed across domains. Given the negligible magnitude and absence of systematic patterns, analyses were conducted using WLSMV estimation without imputation. Within the maintenance domain, several items exhibited pronounced ceiling effects, with 85%–95% of responses concentrated in the highest category, indicating restricted variability. Item–total correlations ranged widely, with particularly low values for i10 (0.16) and i18 (0.12). In contrast, the monitoring domain showed balanced response distributions and strong internal homogeneity (item–total $r=0.51$ – 0.85). The management domain demonstrated moderate-to-strong item–total correlations ($r=0.33$ – 0.76), although some items (e.g., i34–i37) displayed ceiling tendencies (Table 2). These findings guided subsequent structural and IRT analyses.

3.4 | Confirmatory Factor Analysis

Based on previous evidence from self-care instruments and on the theoretical distinction between treatment-related behaviours and lifestyle/prevention behaviours, an initial two-factor model was specified for the self-care maintenance scale (Riegel et al. 2018). The first factor, clinical adherence, included items related to following medical recommendations and treatment regimens, whereas the second factor, lifestyle/prevention, included items addressing health-promoting and preventive behaviours. This model was then tested using confirmatory factor analysis. This initial two-factor model showed inadequate fit. Distributional irregularities and unstable polychoric correlations were particularly evident for i2 and i3. After removing these items and specifying a theoretically justified residual covariance (i14–i15), model fit improved, although the SRMR remained slightly above the prespecified threshold:

$\chi^2(131)=249.44$, RMSEA=0.055 [0.044–0.065], CFI=0.925, TLI=0.912, SRMR=0.081. Standardized loadings were acceptable for adherence ($\lambda=0.56$ – 0.79). Within lifestyle/prevention, most loadings were moderate ($\lambda=0.37$ – 0.61), while i10 ($\lambda=0.15$) and i18 ($\lambda=0.22$) showed comparatively weak loadings, although both were statistically significant in the domain-specific model (Table 3). Consistent with previous self-care instruments, in which self-care monitoring has been conceptualized and tested as a unidimensional construct, a one-factor model was specified for the self-care monitoring scale (Di Nitto, Ucciero, et al. 2025; Riegel et al. 2018). This model initially showed localized strain. Following examination of model diagnostics and consideration of the conceptual similarity between the items a theoretically justified residual covariance (i26–i27) resulted in good fit: $\chi^2(19)=47.88$, RMSEA=0.071 [0.046–0.096], CFI=0.992, TLI=0.988, SRMR=0.041. Most factor loadings were strong, although i26 ($\lambda=0.28$) and i27 ($\lambda=0.26$) showed comparatively weaker psychometric performance (Table 3). Consistent with previous self-care instruments, which have described self-care management as involving both autonomous responses (e.g., seeking guidance or reacting to symptom changes) and consultation with healthcare providers (e.g., seeking guidance or reacting to symptom changes), a two-factor CFA model was specified for the management scale (Riegel et al. 2018). The model demonstrated satisfactory fit ($\chi^2(53)=86.65$, RMSEA=0.044 [90% CI 0.026–0.062], CFI=0.970, TLI=0.963, SRMR=0.056; Table 3).

3.4.1 | Simultaneous Confirmatory Factor Analysis

In the simultaneous CFA modelling all domains jointly, model fit was generally adequate, although not all fit indices met the prespecified criteria (RMSEA=0.050; CFI=0.925; TLI=0.919; SRMR=0.087). Most items showed statistically significant standardized loadings on their intended factors. The only exception was i10 within the lifestyle factor, which displayed a negligible and non-significant loading (STDYX=−0.052, $p=0.514$), consistent with its weak performance in the domain-specific model. Item 18 and monitoring items i26 and i27 also showed comparatively weaker psychometric performance than most other items (Table 3). The residual covariances between i14–i15 and i26–i27 remained statistically significant in the simultaneous model. The final confirmatory factor analysis models for the Maintenance, Monitoring, and Management domains are presented in Figure 1.

3.5 | Item Response Theory Analysis

For maintenance, IRT results mirrored CFA findings. Items i2 and i3 demonstrated extremely low discrimination parameters and poorly distributed thresholds, confirming limited contribution to latent trait differentiation. Most remaining items showed moderate discrimination (a parameters in the acceptable range), whereas i10 and i18 exhibited low discrimination and contributed minimal information. Test information curves indicated adequate precision around average levels of maintenance but reduced information at higher trait levels, consistent with observed ceiling effects. Regarding monitoring, all items demonstrated strong discrimination parameters, and threshold ordering was appropriate across response categories. The

TABLE 2 | Descriptive statistics and response distributions for all items of the Self-care of Cancer Inventory across maintenance, monitoring, and management domains (*n* = 305).

Domain	Item	Item content	“Never”, <i>n</i> (%)	“Rarely”, <i>n</i> (%)	“Sometimes”, <i>n</i> (%)	“Often”, <i>n</i> (%)	“Always”, <i>n</i> (%)	Item- total <i>r</i>
Maintenance	i1	Adherence to prescribed treatment plan	—	1 (0.3)	1 (0.3)	8 (2.6)	293 (96.7)	0.54
	i2	Attendance to recommended medical visits	—	—	—	4 (1.3)	298 (98.7)	0.29
	i3	Completion of prescribed diagnostic tests	—	—	—	2 (0.7)	300 (99.3)	0.34
	i4	Adaptation of daily activities to health condition	—	2 (0.7)	3 (1.0)	60 (19.8)	238 (78.5)	0.52
	i5	Maintaining physical activity	5 (1.7)	35 (11.6)	86 (28.4)	89 (29.4)	88 (29.0)	0.29
	i6	Following recommended nutrition	1 (0.3)	11 (3.6)	34 (11.2)	120 (39.5)	138 (45.4)	0.40
	i7	Maintaining adequate hydration	1 (0.3)	24 (7.9)	49 (16.2)	87 (28.7)	142 (46.9)	0.37
	i8	Avoidance of smoking exposure	29 (9.6)	17 (5.6)	14 (4.6)	19 (6.3)	224 (73.9)	0.23
	i9	Limiting alcohol consumption	—	7 (2.3)	6 (2.0)	31 (10.2)	259 (85.5)	0.53
	i10	Seeking reliable health information from professionals	18 (5.9)	31 (10.2)	18 (5.9)	57 (18.8)	179 (59.1)	0.16
	i11	Discussing medication side effects with professionals	5 (1.7)	14 (4.6)	29 (9.6)	61 (20.1)	194 (64.0)	0.39
	i12	Consulting professionals about OTC drugs/supplements	13 (4.3)	23 (7.6)	28 (9.2)	48 (15.8)	191 (63.0)	0.54
	i13	Maintaining body and oral hygiene	—	1 (0.3)	10 (3.3)	63 (20.8)	229 (75.6)	0.49
	i14	Protecting skin from injury	11 (3.7)	45 (15.1)	46 (15.4)	79 (26.4)	118 (39.5)	0.37

(Continues)

TABLE 2 | (Continued)

Domain	Item	Item content	“Never”, n (%)	“Rarely”, n (%)	“Sometimes”, n (%)	“Often”, n (%)	“Always”, n (%)	Item- total <i>r</i>
	i15	Protecting skin from sun exposure	12 (4.0)	40 (13.2)	46 (15.2)	84 (27.7)	121 (39.9)	0.48
	i16	Infection prevention behaviours	3 (1.0)	5 (1.7)	29 (9.6)	70 (23.1)	196 (64.7)	0.40
	i17	Maintaining meaningful social relationships	2 (0.7)	5 (1.7)	7 (2.3)	32 (10.6)	257 (84.8)	0.52
	i18	Seeking peer support from similar patients	159 (52.5)	63 (20.8)	45 (14.9)	18 (5.9)	18 (5.9)	0.12
	i19	Engagement in leisure activities	5 (1.7)	26 (8.6)	43 (14.2)	107 (35.4)	121 (40.1)	0.43
	i20	Maintaining regular sleep habits	5 (1.7)	11 (3.6)	31 (10.2)	105 (34.7)	151 (49.8)	0.50
Monitoring	i21	Monitoring treatment side effects	16 (5.3)	22 (7.3)	31 (10.2)	61 (20.1)	173 (57.1)	0.78
	i22	Monitoring new symptoms	34 (11.2)	21 (6.9)	24 (7.9)	60 (19.8)	164 (54.1)	0.85
	i23	Monitoring pain intensity	41 (13.6)	26 (8.6)	30 (10.0)	59 (19.6)	145 (48.2)	0.77
	i24	Monitoring fatigue during daily activities	9 (3.0)	20 (6.6)	62 (20.5)	95 (31.4)	117 (38.6)	0.64
	i25	Monitoring skin/oral condition	25 (8.3)	20 (6.6)	27 (8.9)	105 (34.7)	126 (41.6)	0.73
	i26	Monitoring body weight	12 (4.0)	26 (8.6)	36 (11.9)	71 (23.4)	158 (52.1)	0.31
	i27	Monitoring clinical parameters (e.g., BP, temperature)	9 (3.0)	22 (7.3)	50 (16.6)	75 (24.8)	146 (48.3)	0.31
	i28	Monitoring emotional state	17 (5.6)	42 (13.9)	100 (33.0)	75 (24.8)	69 (22.8)	0.51

(Continues)

TABLE 2 | (Continued)

Domain	Item	Item content	“Not at all likely”, <i>n</i> (%)	“Slightly likely”, <i>n</i> (%)	“Moderately likely”, <i>n</i> (%)	“Very likely”, <i>n</i> (%)	“Totally likely”, <i>n</i> (%)	Item-total <i>r</i>
Management	i29	Dietary adjustments in response to symptoms	17 (5.6)	7 (2.3)	70 (23.2)	15 (5.0)	193 (63.9)	0.53
	i30	Adjusting activities when fatigued	7 (2.3)	7 (2.3)	70 (23.2)	25 (8.3)	193 (63.9)	0.69
	i31	Planning activities to optimize energy	18 (5.9)	7 (2.3)	73 (24.1)	21 (6.9)	184 (60.7)	0.76
	i32	Adapting routines to manage symptoms	14 (4.7)	6 (2.0)	86 (28.6)	40 (13.3)	155 (51.5)	0.61
	i33	Using home remedies for symptom relief	128 (42.5)	30 (10.0)	86 (28.6)	15 (5.0)	42 (14.0)	0.33
	i34	Managing symptoms following professional advice	5 (1.7)	3 (1.0)	39 (12.9)	21 (7.0)	234 (77.5)	0.70
	i35	Seeking professional advice for symptom management	3 (1.0)	2 (0.7)	26 (8.6)	16 (5.3)	255 (84.4)	0.66
	i36	Contacting professionals when unable to self-manage	4 (1.3)	1 (0.3)	26 (8.6)	9 (3.0)	262 (86.8)	0.72
	i37	Reporting symptoms to professionals during visits	—	—	16 (5.3)	11 (3.6)	275 (91.1)	0.67
	i38	Communicating emotional distress to professionals	59 (19.5)	18 (6.0)	99 (32.8)	29 (9.6)	97 (32.1)	0.34
	i39	Sharing emotions with close persons	20 (6.6)	12 (4.0)	75 (24.8)	31 (10.3)	164 (54.3)	0.48
	i40	Engaging in stress-reducing activities	7 (2.3)	5 (1.7)	57 (18.9)	25 (8.3)	208 (68.9)	0.50

Note: Response options were rated on a five-point ordinal scale ranging from *Never to Always* for self-care maintenance and monitoring items, and from *Not at all likely to Totally likely* for self-care management items. Values are presented as frequency distributions for each response category. Corrected item-total correlations were calculated within each domain to assess item homogeneity and contribution to internal consistency; values ≥ 0.30 were considered indicative of acceptable item performance. Items with very high endorsement rates were inspected for potential ceiling effects and limited variability. Short item descriptions represent conceptual summaries and are provided to facilitate interpretation of behavioural content without reproducing full item wording.

Abbreviations: BP, blood pressure; OTC, over the counter drugs.

TABLE 3 | Sequential confirmatory factor analysis models and fit indices across maintenance, monitoring, and management dimensions of the Self-care of Cancer Inventory.

Domain	Model	Model description/modification	χ^2	df	RMSEA (90% CI)	CFI	TLI	SRMR	Notes
Maintenance	Maint1	Initial theory-driven two-factor CFA; all items retained and assigned to theoretical domains	424.57	167	0.071 (0.063–0.080)	0.821	0.796	0.156	Theory-driven starting model
Maintenance	Maint2	Two-factor CFA after removing items i2 and i3 (extreme ceiling effects leading to unstable polychoric correlations) and adding residual covariance i14 ↔ i15 reflecting conceptual overlap between prevention behaviours	249.44	131	0.055 (0.044–0.065)	0.925	0.912	0.081	Substantial improvement in incremental fit; theory-consistent local dependence
Monitoring	Monit1	Unidimensional CFA; initial model with localized strain; strong residual association identified between i26 and i27	93.13	20	0.110 (0.088–0.133)	0.980	0.972	0.115	Acceptable incremental fit but poor absolute fit; local dependence detected
Monitoring	Monit2	Added residual covariance i26 ↔ i27	47.88	19	0.071 (0.046–0.096)	0.992	0.988	0.041	Excellent incremental fit
Management	Manag1	Initial theory-driven two-factor CFA; all items retained and assigned to theoretical domains	84.65	53	0.044 (0.026–0.062)	0.970	0.963	0.056	Initial specification with satisfactory global fit
All domains	Full1	Simultaneous CFA of final domain structures estimated jointly (Maintenance: two-factor; Monitoring/Management: unidimensional), allowing correlations among latent factors and retaining theory-consistent residual covariances (i14 ↔ i15; i26 ↔ i27)	1141.05	653	0.050 (0.045–0.054)	0.925	0.919	0.087	Acceptable global fit; residual covariances capture localized dependence; i10 showed non-significant loading

Note: CFA models were estimated using WLSMV for categorical indicators. Model development followed a theory-informed, process-oriented refinement strategy grounded in the Middle-Range Theory of Self-Care of Chronic Illness. Sequential model modifications were introduced conservatively and only when supported by conceptual rationale and psychometric diagnostics. Fit indices are reported as χ^2 (chi-square test of model fit), RMSEA (root mean square error of approximation), CFI (comparative fit index), TLI (Tucker–Lewis index), and SRMR (standardized root mean square residual).

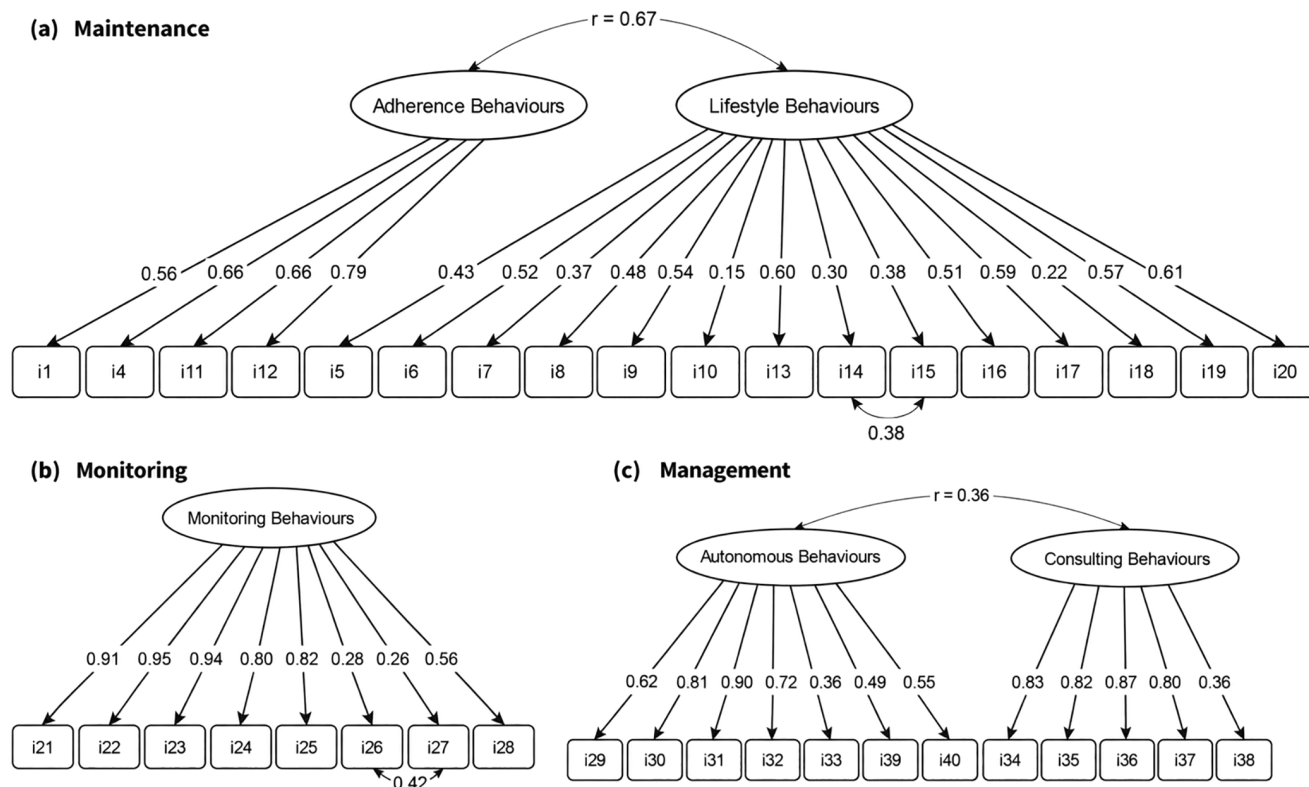


FIGURE 1 | Confirmatory factor analysis models of the self-care of cancer inventory domains: (a) Maintenance (two-factor structure), (b) Monitoring (unidimensional structure), and (c) Management (two-factor structure). Standardized factor loadings are displayed.

domain provided high test information across a broad range of the latent continuum, with peak precision around moderate-to-high monitoring levels. The local dependence observed between i26 and i27 was also reflected in overlapping item information curves. Discrimination parameters for management were moderate to high across most items. Items reflecting professional consultation behaviours showed slightly higher discrimination compared to autonomous self-regulation items. Test information curves demonstrated satisfactory precision across mid-range levels of management, with moderate attenuation at extreme trait values. Additional IRT results, including full item parameter estimates and information curves, are presented in (Tables S5–S7, Figure S1).

3.6 | Internal Consistency and Construct Replicability

Reliability estimates indicated adequate-to-good internal consistency across domains: Maintenance: $\omega = 0.74$, Monitoring: $\omega = 0.85$, and Management: $\omega = 0.79$. Factor-specific reliability estimates were also examined for the multidimensional domains. Within Maintenance, ordinal omega was 0.67 for Adherence behaviours and 0.63 for Lifestyle/Prevention behaviours. Within Management, reliability was higher, with $\omega = 0.80$ for Autonomous behaviours and $\omega = 0.71$ for Consulting behaviours. Construct replicability indicated good to excellent factor definition (maintenance adherence $H = 0.77$; lifestyle/prevention $H = 0.78$; monitoring $H = 0.91$; management $H = 0.88$).

3.7 | Test–Retest Reliability

Test–retest analyses demonstrated acceptable temporal stability across all domains of the Self-Care of Cancer Inventory. The maintenance domain showed good reliability (ICC = 0.739, 95% CI 0.648–0.809, $p < 0.001$). Similarly, the monitoring domain exhibited good stability over time (ICC = 0.710, 95% CI 0.611–0.787, $p < 0.001$), as well as the management domain (ICC = 0.701, 95% CI 0.599–0.780, $p < 0.001$).

3.8 | Convergent and Known-Groups Validity

Health literacy showed positive, small-to-moderate correlations with all three self-care domains: maintenance ($r = 0.234$, $p < 0.001$), monitoring ($r = 0.294$, $p < 0.001$), and management ($r = 0.361$, $p < 0.001$), in line with theoretical expectations. Regarding health locus of control, internal and chance orientations were not significantly correlated with any self-care domain (all $p > 0.05$). In contrast, doctors' health locus of control showed significant positive correlations with monitoring ($r = 0.256$, $p < 0.001$) and management ($r = 0.290$, $p < 0.001$), but not with maintenance ($p > 0.05$). Others' health locus of control was significantly associated only with management ($r = 0.204$, $p < 0.001$), with no significant correlations observed for maintenance or monitoring (all $p > 0.05$). Age demonstrated small but statistically significant positive correlations with maintenance ($r = 0.126$, $p = 0.028$), monitoring ($r = 0.166$, $p = 0.004$), and management ($r = 0.164$, $p = 0.004$). Sex differences were examined using independent-samples t -tests. Females reported

significantly higher scores than males across maintenance ($M=82.62$ vs. 78.72 ; $t=-3.25$, $p=0.001$), monitoring ($M=77.02$ vs. 71.63 ; $t=-2.43$, $p=0.016$), and management ($M=81.40$ vs. 76.98 ; $t=-2.73$, $p=0.007$). Educational attainment and living alone were not significantly associated with any self-care domain (all $p>0.05$; Table 4).

3.9 | Differential Item Functioning Analyses

For the maintenance domain, two lifestyle/prevention items (i9 and i13) demonstrated statistically significant uniform DIF across sex; however, graphical inspection of category response functions indicated minimal threshold shifts with largely overlapping curves and no evidence of non-uniform DIF, suggesting negligible practical impact. Across age groups, three maintenance items (i4, i10, and i15) showed statistically significant uniform DIF after correction; nevertheless, response curves were highly overlapping and reflected small threshold shifts consistent with mean-level age differences rather than substantive measurement bias. No significant DIF was detected for the monitoring domain or for either management subdimension across sex or age.

4 | Discussion

The present study aimed to develop and test the psychometric properties of the SC-CI scale to measure the level of self-care in patients diagnosed with cancer. Overall, the findings provide encouraging evidence for the psychometric adequacy of the SC-CI. The results suggest that the SC-CI captures the multidimensional nature of cancer self-care in a conceptually coherent manner, with differences in the psychometric performance of its domains. In particular, the monitoring and management subscales demonstrated more robust measurement properties, whereas the maintenance subscale emerged as the most psychometrically challenging component of the instrument.

Regarding item characteristics, the main critical issues concerned the maintenance domain. Items 2 (“Attend all medical visits as recommended by healthcare professionals”) and 3 (“Do the prescribed tests (e.g., blood tests, ultrasound scans, CT scans) for the management of your cancer condition”) showed pronounced ceiling effects, weak item-total correlations, and reduced discrimination, suggesting that these behaviours function as highly normative components of oncology care. Within the self-care maintenance domain, such behaviours may be perceived as necessary to ensure treatment continuity rather than optional, leading to response clustering at the upper categories and reduced variability (Eckhard et al. 2021). This pattern is likely reinforced by the clinical profile of the sample, characterized by predominantly preserved functional status (ECOG 0–1; Chen et al. 2024; Oken et al. 1982).

By contrast, items i10 and i18, although showing weaker corrected item-total correlations, were retained for CFA because they did not show pronounced ceiling effects and therefore do not appear to reflect strongly normative behaviours. This strategy consists of recommendations for multidimensional instruments, in which theoretically meaningful items may perform

suboptimally on preliminary homogeneity indices yet still warrant testing within the hypothesized factor structure (Boateng et al. 2018). However, subsequent CFA findings provided additional evidence of weak performance for these items. In particular, i10 showed a very low loading in the domain-specific model and a negligible, nonsignificant loading in the simultaneous model, while i18 also showed a comparatively weak loading. Their retention was therefore primarily based on their theoretical and content relevance rather than on strong psychometric performance in the present sample. For item i18, low endorsement may reflect contextual features of the Italian oncology setting rather than limited conceptual relevance. Peer-support activities are not consistently integrated into routine care (Cipolat Mis et al. 2015), and patients often rely more on direct interactions with healthcare professionals (Truccolo et al. 2019), which may reduce the salience of this behaviour within the observed sample.

Structural validity findings generally supported the hypothesized multidimensional structure of the SC-CI and were broadly consistent with evidence from comparable self-care instruments. In the original development study of the Self-Care of Chronic Illness Inventory (SC-CII), self-care maintenance was operationalized as a two-dimensional domain, self-care monitoring as a single-factor construct, and self-care management as a two-factor domain distinguishing autonomous from consulting behaviours (Riegel et al. 2018). Further support for this factorial structure was provided by a subsequent psychometric evaluation of the SC-CII in patients living with cancer, which reported supportive model fit indices (Di Nitto, Durante, et al. 2025).

Among the SC-CI subscales, monitoring showed the strongest structural performance, with balanced response distributions, satisfactory item-total correlations, and support for a largely unidimensional structure after limited refinement. Nevertheless, items i26 and i27 showed comparatively weaker psychometric performance than the other monitoring items, and their residual covariance suggests shared item-specific variance beyond that explained by the general monitoring factor. Although their content remains relevant to the conceptual coverage of self-care monitoring, their performance warrants further examination in independent samples. This finding is coherent with previous evidence from both chronic illness and oncology settings. In the SC-CII, monitoring was identified as a single-factor scale (Riegel et al. 2018), and the same pattern was observed in the Self-Care of Oral Anticancer Agents Index (SCOAAI), in which the monitoring scale also showed a one-factor solution with excellent fit indices (Di Nitto, Ucciero, et al. 2025). Taken together, these findings suggest that symptom surveillance and attention to bodily changes may represent a relatively stable component of self-care across different clinical contexts.

The self-care management subscale also demonstrated satisfactory structural validity. Its two-factor structure is consistent with previous psychometric findings distinguishing behaviours performed autonomously from those involving consultation with healthcare professionals. In the SC-CII, management was originally described as comprising autonomous and consulting behaviours (Riegel et al. 2018), whereas in the SCOAAI the corresponding dimensions were labelled problem-solving behaviours and consulting behaviours, again reflecting the

TABLE 4 | Pattern of expected versus observed associations supporting convergent and known-groups validity.

External variable	Theoretical expectation	Maintenance	Monitoring	Management	Interpretation
Health literacy (HLS)	Positive association (knowledge-based self-care)	$r = 0.234, p < 0.001$	$r = 0.294, p < 0.001$	$r = 0.361, p < 0.001$	Strong support; increasing gradient across domains consistent with cognitive demands
Internal HLOC	Weak/moderate positive	ns	ns	ns	Limited support; may reflect behavioural rather than control-oriented construct
Chance HLOC	Null or negative	ns	ns	ns	Consistent; self-care not driven by external chance beliefs
Doctors HLOC	Positive (medical guidance reliance)	ns	$r = 0.256, p < 0.001$	$r = 0.290, p < 0.001$	Strong support, especially for monitoring/management
Others HLOC	Weak positive expected	ns	ns	$r = 0.204, p < 0.001$	Partial support; social reliance modestly related to management
Age	Small positive	$r = 0.126, p = 0.028$	$r = 0.166, p = 0.004$	$r = 0.164, p = 0.004$	Consistent; older participants slightly higher engagement
Sex (male vs. female)	Small-to-moderate group differences expected	$M(F) = 82.62$ vs. $M(M) = 78.72$; $t = -3.25, p = 0.001$	$M(F) = 77.02$ vs. $M(M) = 71.63$; $t = -2.43, p = 0.016$	$M(F) = 81.40$ vs. $M(M) = 76.98$; $t = -2.73, p = 0.007$	Significant known-groups validity; systematic sex differences across domains
Educational attainment (> 8 years vs. ≥ 9 years)	Expected higher self-care with higher education	ns	ns	ns	No known-groups validity; education may be less relevant than functional health literacy
Living alone (yes/no)	Lower self-care expected if living alone	ns	ns	ns	No known-groups validity; self-care appears independent of household context
Married/partnered (no/yes)	Higher self-care expected if married/partnered	Not partnered = 77.71 vs. partnered = 80.82; $t = -2.47, p = 0.014$	ns	ns	Partial known-groups validity; partnership associated with higher maintenance only

distinction between self-initiated actions and professional help-seeking (Di Nitto, Ucciero, et al. 2025).

By contrast, the maintenance subscale required more substantial model refinement. Acceptable fit was achieved only after removal of items i2 and i3 and the inclusion of a theoretically justified residual covariance between items i14 and i15, likely reflecting their conceptual overlap. The greater heterogeneity observed in the present study may reflect the specific complexity of cancer self-care, which may include health-promoting behaviours, treatment adherence, prevention of complications, management of treatment-related effects, and reliance on social and professional support across different phases of the disease trajectory (Been-Dahmen et al. 2024; Howard-Jones et al. 2022). In this context, retaining items i10 and i18 was considered important to preserve content validity; however, particularly for i10, their weaker factorial performance indicates that their contribution to the maintenance construct remains uncertain. These items should therefore be reassessed in independent validation samples, where rewording or removal may be considered if their weak performance is replicated.

With regard to reliability, the SC-CI monitoring and management subscales provided the strongest evidence, showing greater internal homogeneity, satisfactory construct replicability, and acceptable temporal stability. This pattern is consistent with findings from comparable instruments, including the SC-CII (Riegel et al. 2018) and the SCOAAI (Di Nitto, Ucciero, et al. 2025), in which monitoring and management generally display more robust psychometric performance than maintenance. By contrast, the SC-CI maintenance subscale showed weaker reliability indices, in line with the item-level and CFA results. Similar evidence from the SC-CII and SCOAAI suggests that maintenance is typically the most heterogeneous domain, likely because it encompasses a broad range of behaviours that vary in relevance, perceived importance, and contextual dependence. Factor-specific reliability estimates further supported retaining the broader domain scores: the two maintenance factors showed modest reliability, whereas the two management factors showed adequate reliability. Consistent with the established scoring approach adopted across other self-care instruments derived from the Middle-Range Theory of Self-Care of Chronic Illness, Maintenance and Management were therefore retained as the primary scoring levels, while factor-specific reliability was reported to characterize their internal structure. Overall, these findings support the reliability of the SC-CI, while indicating that the maintenance domain may warrant further refinement.

Evidence for external validity was also favourable. The positive, small-to-moderate associations between health literacy and all three self-care domains were consistent with the hypothesized direction and with prior cancer literature linking health literacy to self-management behaviours, treatment uptake, and patients' ability to understand and use cancer-related information effectively (Holden et al. 2021; Papadakis et al. 2018). These findings provide limited to moderate support for the convergent validity of the SC-CI.

The pattern observed for health locus of control was also informative. The absence of significant associations for internal and chance orientations is in line with evidence suggesting that health

locus of control is not uniformly associated with health behaviour across outcomes and contexts (Náfrádi et al. 2017). In contrast, the positive associations of doctor health locus of control with monitoring and management are theoretically plausible, as these domains are more directly related to symptom appraisal, clinical guidance, and treatment-related decision-making. This interpretation is supported by literature linking doctor-attributed control beliefs with adherence and showing that locus of control is relevant to communication and decision-making processes in clinical care (Rodriguez et al. 2023). In oncology, where patients frequently depend on clinicians to interpret symptoms and manage complex treatment pathways, these associations may be particularly meaningful (Dopelt et al. 2022). The association between others' health locus of control and management only may suggest that management behaviours are more socially mediated; however, this interpretation should remain cautious, as available evidence indicates that social and caregiver influences may extend beyond management alone and may also contribute to other self-care domains (Gallant 2003).

The finding that women reported higher scores in self-care maintenance, monitoring, and management is partly consistent with previous self-care literature, which has associated male sex with poorer self-care in several chronic illness populations, particularly in self-care monitoring and management (Mei et al. 2019). Although these gender-related differences may not be consistent across all self-care domains and clinical populations, our finding may reflect broader gender-related differences in engagement with care, support needs, and self-advocacy that have been described in cancer populations (Lazris et al. 2025).

Finally, the DIF analyses support the practical comparability of scores across sex and age groups: although some statistically significant DIF was detected in maintenance items, the graphical overlap and minimal threshold shifts suggest negligible practical impact.

4.1 | Strengths and Limitations

This study has several strengths. First, it introduces and psychometrically tests a theory-driven instrument specifically designed to assess self-care in people living with cancer. A key strength of the SC-CI is its theory-guided development, which ensured that the main domains of self-care (maintenance, monitoring, and management) were represented in the instrument. This multidimensional approach may provide a broader and more clinically flexible assessment framework than instruments focused on specific symptoms or treatment settings. This may be particularly relevant in oncology, where available measures are often symptom- or treatment-specific, while self-care is increasingly recognized as a multidimensional process that extends across cancer types, treatment modalities, and phases of the disease trajectory (Van Dongen et al. 2020). Second, the study was conducted in accordance with the COSMIN framework for patient-reported outcome measures, supporting the methodological rigour of the psychometric evaluation and the adequacy of the sample for factor-analytic testing. Third, the inclusion of patients with advanced disease receiving active systemic treatment enhanced the clinical relevance of the study, as self-care is especially salient in populations exposed to complex symptom burden and treatment demands (McCorkle et al. 2011; Vogt et al. 2021).

Several limitations should also be acknowledged. First, participants were recruited from a single hospital within a single national context and from a restricted set of cancer sites, and the sample consisted predominantly of older men with metastatic solid tumours receiving first-line systemic anticancer therapy. These characteristics may limit generalizability of the findings to broader oncological populations. In particular, some highly incident tumour groups were not represented in the sample, most notably breast cancer (Bray et al. 2024). Second, although preliminary DIF findings supported the practical comparability of scores across sex and age, full measurement invariance testing was not feasible because of subgroup size limitations; therefore, larger and more heterogeneous studies are needed to verify the stability of the SC-CI across sex, age, cancer type, disease stage, and treatment modality. In addition, some retained items, particularly i10 and, to a lesser extent, i18, i26, and i27, showed comparatively weak psychometric performance. Moreover, although the initial factor structures were theoretically specified *a priori*, subsequent item removal and the inclusion of residual covariances were informed by model diagnostics derived from the same sample. As these modifications were not cross-validated in an independent sample, some degree of sample-specific model optimization cannot be excluded. Therefore, both the performance of these items and the revised factor structure should be further evaluated and confirmed in independent oncology samples. Clinical stability was also not formally assessed during the 2-week test-retest interval; thus, some true change related to ongoing systemic anticancer treatment may have contributed to the observed test-retest variability. Furthermore, responsiveness and measurement error were not assessed; consequently, the ability of the SC-CI to detect clinically meaningful changes in self-care over time remains to be established. Further longitudinal studies are needed before its use for monitoring changes in self-care over time can be supported. Finally, predictive validity was not assessed; thus, future longitudinal analyses should examine the extent to which SC-CI scores predict clinically relevant outcomes, including mortality and healthcare utilization (e.g., hospital admissions, emergency department visits).

4.2 | Implications for Clinical Practice and Research

The present findings have several implications for clinical practice and future research. From a clinical perspective, the SC-CI shows potential as a multidimensional approach to assessing self-care needs in patients with metastatic solid tumours receiving first-line systemic anticancer therapy, rather than relying exclusively on multiple symptom- or treatment-specific questionnaires. Although its broader applicability across different tumour types, treatment settings, and phases of care remains to be established through further validation, its multidimensional structure may offer a framework for assessing different aspects of cancer self-care within a single instrument. This broader approach is consistent with current recommendations in oncology, which increasingly emphasize flexible patient-reported outcome strategies that retain conceptual comparability while allowing contextual adaptation (Piccinin et al. 2023). Within this framework, items 2 and 3 may be retained as supplementary clinical indicators rather than included in the maintenance subscale score. Although their psychometric contribution to the latent

maintenance factor was limited in the present sample, they reflect normative aspects of oncology care, such as attending scheduled visits and completing recommended tests, and may still be clinically informative when considered separately (Basch et al. 2016; Steele et al. 2024). Future applications of the SC-CI may therefore exclude these items from scoring while preserving their descriptive clinical value. This dual use may be particularly valuable in cross-context applications. In health systems characterized by higher financial barriers, lower insurance coverage, transportation difficulties, or marked socioeconomic deprivation, attendance at visits and completion of prescribed tests might no longer represent near-universal behaviours, but rather important sources of between-patient variability (A. M. Chen 2023; Gordon et al. 2025). Future studies should examine the performance of SC-CI in more heterogeneous samples and across different health-care systems, including formal tests of measurement invariance and cross-context structural validity.

5 | Conclusion

The present study provides promising initial psychometric evidence for the Self-Care of Cancer Inventory as a multidimensional measure of self-care in patients with metastatic solid tumours receiving first-line systemic anticancer therapy. Importantly, some weaker-performing items may still retain clinical relevance, although their psychometric performance requires further evaluation in independent samples. Overall, the SC-CI represents a promising theory-based instrument for assessing cancer-related self-care within the population studied; however, further validation in independent and more diverse oncology samples, including different cancer types, disease stages, treatment settings, and healthcare contexts, is required before broader clinical application can be supported.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

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

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Table S1:** Sociodemographic characteristics of the experts involved in the two-round expert consultation ($n = 20$). **Table S2:** Characteristics of patients involved in the cognitive interviews ($n = 10$). **Table S3:** Item-level Content Validity Index (I-CVI) and Scale-level Content Validity Index (S-CVI/Ave) for the Self-Care of Cancer Inventory (SC-CI), version 1. **Table S4:** Item-level Content Validity Index (I-CVI) and Scale-level Content Validity Index (S-CVI/Ave) for the Self-Care of Cancer Inventory (SC-CI), version 2. **Table S5:** Graded response model parameters for the maintenance domain (self-care of cancer inventory). **Table S6:** Graded response model parameters for the monitoring domain (self-care of cancer inventory). **Table S7:** Graded response model parameters for the management domain (self-care of cancer inventory). **Figure S1:** Comparative test information functions across SC-CI domains and subdimensions. **Table S8:** SC-CI self-care maintenance scale. **Table S9:** SC-CI self-care monitoring scale. **Table S10:** SC-CI self-care management scale.