Original Paper

Reliability and Validity of the Greek Version of the Needs Assessment Tool for Family Caregivers of Cancer Patients

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ABSTRACT: Background: Cancer deeply impacts family caregivers, leading to significant burden, unmet needs, and a decline in their overall quality of life. The primary aim of this study was to evaluate the reliability and validity of the Greek version of the Needs Assessment Tool for Family Caregivers-Cancer (NAFC-C). Methodology: A cross-sectional study was conducted at a tertiary anticancer hospital in Athens involving a convenience sample of 100 caregivers. Participants completed the Greek version of the 27-item NAFC-C and the revised Bakas Caregiving Outcomes Scale (BCOS).Reliability was tested using Cronbach's alpha for internal consistency and Intraclass Correlation Coefficients (ICC) for test-retest stability. Validity was assessed through Confirmatory Factor Analysis (CFA) and correlation with the BCOS. Results: Participants were primarily female (72%), married (74%), and most frequently the patient's spouse (44%).The CFA confirmed that the four-factor model, comprising psychosocial, medical, financial, and daily unmet needs, provided an excellent fit for the Greek population. Strong positive correlations were observed between these factors, particularly between psychosocial and medical unmet needs (r=0.99). Convergent validity was confirmed through a moderate but significant negative correlation between the total NAFC-C score and the BCOS scale (r=-0.35, p<0.001) indicating that higher unmet needs were associated with less favorable caregiving outcomes. The instrument also demonstrated high internal consistency, with a total Cronbach's alpha of 0.894 and individual factor alphas ranging from 0.601 to 0.755.Additionally, test-retest reliability was confirmed with ICC values for the 27 items ranging from 0.51 to 0.95 (p<0.05), demonstrating strong stability over time. Conclusion: The Greek version of the NAFC-C is a valid and reliable instrument for evaluating the diverse needs of informal cancer caregivers. Its implementation in clinical practice can help healthcare professionals identify overlooked caregiver needs and improve the overall quality of care for both patients and their families in the Greek healthcare system.

KEYWORDS: *Caregivers, cancer, needs assessment tool for family caregivers (nafc-c), reliability, validity.*

Introduction

Cancer is a major global health challenge, with its incidence and associated burden rising significantly worldwide [1].

This disease not only impacts the healthcare system but also places an immense physical, emotional, and financial burden on patients and their families, leading to high unmet needs [2].

Beyond the patient's own struggle, a cancer diagnosis deeply affects the primary caregiver, often leading to a substantial decline in their overall quality of life [3].

Caregivers' quality of life can improve when their specific needs related to cancer care are addressed [4].

An informal or family caregiver is a person, typically a family member, friend, or someone within a personal relationship, who provides essential physical and emotional support to people facing chronic illnesses, disabilities, or long-term health needs.

These individuals generally lack formal medical training or professional healthcare qualifications and provide care within a domestic or personal setting.

Although this role is traditionally unpaid and rooted in personal ties, the definition can also encompass individuals who are not personally related to the recipient and may involve either paid or unpaid arrangements [5].

Caregiver burden refers to an individual's multifaceted reaction to the life changes and specific demands of supporting a patient.

It encompasses the complex physical, psychological, social, and financial burdens experienced by those providing long-term care to a patient [6].

In recent years, research on caregiver burden in oncology has surged as healthcare providers

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realize that caregivers' well-being is intrinsically linked to patient outcomes [7].

Studies worldwide consistently show that cancer patients caregivers face high levels of unmet needs and significant distress throughout various stages of survivorship [4,7-11].

The caregiver burden in cancer is increasingly studied using standardized psychometric tools designed to quantify the specific challenges faced by this population.

There were nearly 40 measurement tools recognized in recent reviews [12,13].

Previous research in the Greek population has validated scales to measure caregiver burden, such as the revised Bakas Caregiving Outcomes Scale (BCOS) [14], and the Zarit Burden Interview (ZBI) [15].

Caregiving needs, on the other hand, are not well described or validated, as only 13 assessment tools for evaluating the needs of cancer caregivers were identified in a recent systematic review [16].

Currently, no validated and translated needs assessment tool is available for Greek caregivers of cancer patients.

Therefore, there is a critical need for an additional culturally adapted tool that can assess the diverse and unmet needs of family caregivers within the peculiarities of the Greek healthcare system.

In Greece, informal caregivers are regarded by the government as valuable assets and are seldom perceived as requiring assistance themselves [17].

The caregiving experience is often shaped by a strong cultural emphasis on family bonds and family-centered care, resulting in distinctive pressures and different support dynamics compared to other regions [18,19].

The Needs Assessment Tool for Family Caregivers-Cancer (NAFC-C) provides a comprehensive framework for identifying these gaps in psychosocial, medical, financial, and daily activity dimensions.

The NAFC-C was developed based on the Need Fulfillment Theory [20], and therefore assesses the importance of the need and the satisfaction with how the need has been fulfilled.

The initial design aimed to recognize the needs of caregivers throughout all stages of cancer survivorship, from diagnosis through the long-term follow-up phase.

The scale has undergone psychometric evaluation in the United States in three cohorts of caregivers (family members or close friends) of patients [21].

It has also been validated in the Asian population [22], validated in Chinese [23], and translated but not validated in Arabic [24].

Overall, NAFC-C validation and use across different cultures remains limited.

Among the available instruments for assessing caregiver needs, the NAFC-C was selected as an appropriate one for the Greek population for several reasons.

Unlike unidimensional tools that measure general distress or those that focus strictly on palliative care, the NAFC-C offers a multidimensional framework that specifically targets four pillars: medical, psychosocial, financial, and daily activity needs [21].

More importantly, its dual-rating system; which evaluates both the importance of a need and the level of satisfaction with its current fulfillment [21], allows for a gap analysis than simple frequency-based scales.

This distinction is vital in Greece.

Greece represents a unique cultural paradigm where informal caregiving is deeply rooted in strong family bonds and social expectations, yet often lacks a formal support framework from the state [17-19].

However, there is a lack of instruments that specifically identify the gap between the importance of a need and its actual fulfillment. While the NAFC-C has demonstrated reliability across various cultural settings [21-24], its application in the Greek context is particularly significant.

By validating the NAFC-C, this study contributes to the international literature by examining how these needs are structured in a family-oriented healthcare system during a period of ongoing social and economic challenges, providing a more granular understanding of caregiver requirements compared to broader burden scales.

This validation study fills a critical knowledge gap by transitioning from a descriptive understanding of caregiver distress to a diagnostic identification of specific service gaps.

Unlike burden scales that measure the weight of caregiving, the NAFC-C identifies exactly where the healthcare system fails the family, providing a roadmap for policy adjustments in Mediterranean healthcare models.

Also, validating this scale in Greek is crucial for providing healthcare professionals with a scientifically supported instrument to identify overlooked needs and develop targeted interventions.

Objective

The primary aim of this study was to evaluate the psychometric properties of the Greek NAFC-C, specifically focusing on Construct Validity and Convergent Validity.

To guide the validation process, the following hypotheses were formulated:

Hypothesis 1 (Construct Validity): The Greek version of the NAFC-C will retain the original four-factor structure (psychosocial, medical, financial, and daily unmet needs), demonstrating an acceptable model fit in Confirmatory Factor Analysis (CFA).

Hypothesis 2 (Convergent Validity): There will be a significant negative correlation between the total NAFC-C score and the BCOS, as higher unmet needs are theoretically expected to associate with less favorable caregiving outcomes.

Hypothesis 3 (Reliability): The instrument will demonstrate high internal consistency (Cronbach's alpha >0.70) and adequate test-retest stability over a 3-day interval.

Methods

Setting and Sample

An observational, cross-sectional, nonrandomized, study was conducted in which measurement scales were used for data collection and multiple methods of data analysis.

The study was carried out between September 2024 and September 2025 in a tertiary public anticancer hospital in Athens, Greece.

Participants were selected from cancer patients attending the oncology outpatient and radiotherapy units.

The sample was collected using convenience sampling and consisted of 100 caregivers of cancer patients.

Participants were adults (aged 18 years or older), caring for a patient with any type and stage of cancer, and they had the ability to provide informed consent, as well as the ability to understand and read Greek.

During the recruitment period, a total of 115 family caregivers were invited to participate in the study.

Of these, 100 met the inclusion criteria and provided fully completed questionnaires, resulting in a response rate of 87%.

The main reasons for non-participation included lack of time or lack of interest in the study topic.

The sample size of 100 participants was deemed sufficient for performing CFA, as the model demonstrated strong factor loadings and excellent fit indices.

According to psychometric guidelines, a sample of 100 is considered the absolute minimum and can provide stable estimates in CFA when the model is well-defined and the fit indices (e.g., CFI, RMSEA) significantly exceed acceptable thresholds [25,26].

Measurements

Caregivers completed the Needs Assessment of Family Caregivers-Cancer (NAFC-C), the revised Bakas Caregiving Outcomes Scale (BCOS), together with demographic and clinical data.

The construct validity of the NAFC-C was examined through a correlation analysis between the NAFC-C and the BCOS subscales.

The time required to complete the questionnaires was approximately 20 minutes.

Revised Bakas Caregiving Outcomes Scale (BCOS)

The revised BCOS is a 15-item tool that evaluates caregivers' views on the changes in their lives resulting from their role in caring for a patient who is also a family member.

An additional 16th item serves as a general measure of how much a caregiver's life has changed due to caring for the patient, although it is not factored into the overall score.

The 15 items of the BCOS focus on social functioning, physical health, and subjective well-being, using a seven-point scale ranging from -3 (indicating a negative change) to +3 (indicating a positive change).

The ratings were converted to scores between +1 and +7, allowing for positive values to be used in the analysis.

Scores exceeding +4 suggest that the caregiver's life has improved, while scores of +4 or lower reflect negative perceptions of the caregiving experience.

The total BCOS score can be derived by adding the item scores, with a potential range of 15 to 105.

Higher total scores indicate more favorable outcomes for caregivers [14,27].

The Greek version was used [14] and had a Cronbach's alpha of 0.926.

The BCOS was selected as the criterion for convergent validity because it captures the multidimensional impact of caregiving on the caregiver's life [27].

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As unmet needs are directly linked to poorer quality of life and less favorable caregiving outcomes [9,10], the Greek version of BCOS [14] was considered an ideal comparator to test whether the Greek NAFC-C effectively identifies the deficit in caregiving outcomes associated with increased unmet needs.

Needs Assessment of Family Caregivers - Cancer (NAFC-C)

The NAFC-C is a 27-item scale designed to evaluate various caregiver needs in cancer care, focusing on two key dimensions: the significance of the need and the level of satisfaction with the fulfillment of that need over the past four weeks.

Both dimensions are measured using a five-point Likert-type scale that ranges from 0 (Not at all) to 4 (Extremely).

The satisfaction ratings for each item were reverse-coded.

For each item, the needs score is calculated by multiplying the satisfaction rating by the importance rating, resulting in a score from 0 to 16, where a higher score indicates a greater degree of unfulfillment.

The scale encompasses four factors: psychosocial unmet needs, medical unmet needs, financial unmet needs, and daily activity unmet needs.

Furthermore, the NAFC-C addresses eight dimensions of family members' needs associated with caring for the cancer survivor, themselves, and other family members.

These eight dimensions include cognitive/informational, communication, daily activity, emotional, financial/legal, medical, social/relationship, and spiritual needs.

Also, the NAFC-C was specifically developed to evaluate the needs of family caregivers throughout different stages of survivorship.

Higher scores indicate a greater number of caregiver's unmet needs [21].

Since the primary goal was to evaluate the validity and reliability of the Greek version of the NAFC-C scale, the following outlines the procedure used.

To ensure maximum level of linguistic accuracy, the original NAFC-C scale was translated into Greek using the forward-backward translation method.

This thorough process involved an initial translation from English into Greek by a bilingual expert, followed by a blind back-translation into English by a second independent translator who had no prior knowledge of the original text.

Comparing these versions, the researchers were able to identify and address any semantic discrepancies, ensuring that the Greek version maintained conceptual equivalence rather than merely providing a literal word-for-word translation.

To ensure cultural equivalence beyond literal translation, a committee consisting of two oncology nursing professors and two clinical oncology nurses, reviewed the back-translated version.

The committee focused on idiomatic and conceptual equivalence, ensuring that terms like unmet needs were translated into Greek phrases that resonate with the cultural expectation of family involvement in care.

Following the translation process, a pilot study was conducted to test the scale in a real-world setting.

This initial phase involved giving the Greek version to a small, representative sample of ten caregivers to evaluate the clarity of instructions and readability of the items.

Although literature suggests larger pilot samples to detect rare item problems [28], a sample of 10-15 participants is widely considered adequate for the cognitive debriefing phase in cross-cultural adaptations [29].

The ten participants were interviewed using a cognitive debriefing approach [30].

They were asked not only if they understood the items, but also if the questions accurately reflected their daily challenges as caregivers in a Greek hospital setting.

This process ensured that the Greek NAFC-C achieved content validity and was culturally sensitive before being administered to the full sample.

Based on participants' feedback and initial data analysis, minor adjustments were made to ensure the final version was culturally relevant and easy to be understood by the target population.

No caregiver deemed any of the scale's items irrelevant, upsetting, or disturbing.

Statistical analysis

Statistical analysis of the data was performed using IBM SPSS Statistics 28.0, while confirmatory factor analysis (CFA) was implemented using AMOS software, version 21.

All tests were two-sided, and a P value of <0.05 was used to denote statistical significance.

Data were screened for normality using skewness and kurtosis indices, and for

multicollinearity through the evaluation of inter-factor correlations.

To assess the structural validity of the Greek version of the NAFC-C scale, CFA was performed using a maximum likelihood estimation method.

Model adequacy was evaluated based on the following established fit indices and predefined thresholds: a ratio of $\chi 2$ to the degrees of freedom ($\chi 2$/df) <5, a Root Mean Square Error of Approximation (RMSEA) <0.08, and values >0.90 for the Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Tucker-Lewis Index (TLI), Incremental Fit Index (IFI), Normed Fit Index (NFI), and Comparative Fit Index (CFI).

Convergent validity was examined through the Pearson correlation coefficient, testing the relationship between NAFC-C scores and the BCOS scale.

At the same time, the reliability of the scale was assessed using Cronbach's alpha for the internal consistency of the individual factors and for the overall instrument, while the stability of the responses was assessed through the test-retest procedure, calculating the Intraclass Correlation Coefficients (ICC).

Results

Descriptive Characteristics

A total of 100 caregivers ultimately participated in the study, with an average age of 55.47 years (SD=11.45).

The sample was predominantly female (72%, n=72) and mostly married.

Regarding their relationship with the patient, the largest group consisted of spouses (44%, n=44).

The sample was nearly evenly split regarding employment status (48% employed, n=48) and the provision of support from other family members (52%, n=52).Additionally, over half of the participants (54%, n=54) had been serving as caregivers for less than a year.

These descriptive characteristics of the sample are detailed below in Table 1.

Table 1. Demographic and caregiving characteristics.

Characteristics	N	%
Gender		
Men	28	28
Women	72	72
Marital status		
Married/ Cohabiting	74	74
Single	17	17
Widowed/ Divorced	9	9
Relationship with the patient		
Spouse	44	44
Child	17	17
Sibling	6	6
Other relative	33	33
Employed		
Yes	48	48
No	52	52
Years as a caregiver		
At least one year	46	46
Less than one year	54	54
Support from others		
Yes	52	52
No	48	48

The Validation of the NAFC-C

Confirmatory Factor Analysis (CFA)

Table 2 and Figure 1 present the results of the CFA.

The CFA confirms that the 4-factor model of the NAFC-C has an excellent fit for the Greek population.

All statistical indices (GFI, AGFI, TLI, CFI, etc.) are within the acceptable limits (>0.9), and the RMSEA (0.043) indicates a very good adjustment.

Therefore, the Greek version of the NAFC-C included four factors: psychosocial, medical, economic, and daily unmet needs.

Table 2. Results of the CFA for the NAFC-C

Model	x2	df	x2/df	RMSEA	GFI	AGFI	TLI	IFI	NFI	CFI
27 items	345.284	292	1.182	0.043	0.912	0.908	0.933	0.948	0.901	0.944
Acceptable values			<5	<0.10	>0.9	>0.9	>0.9	>0.9	>0.9	>0.9

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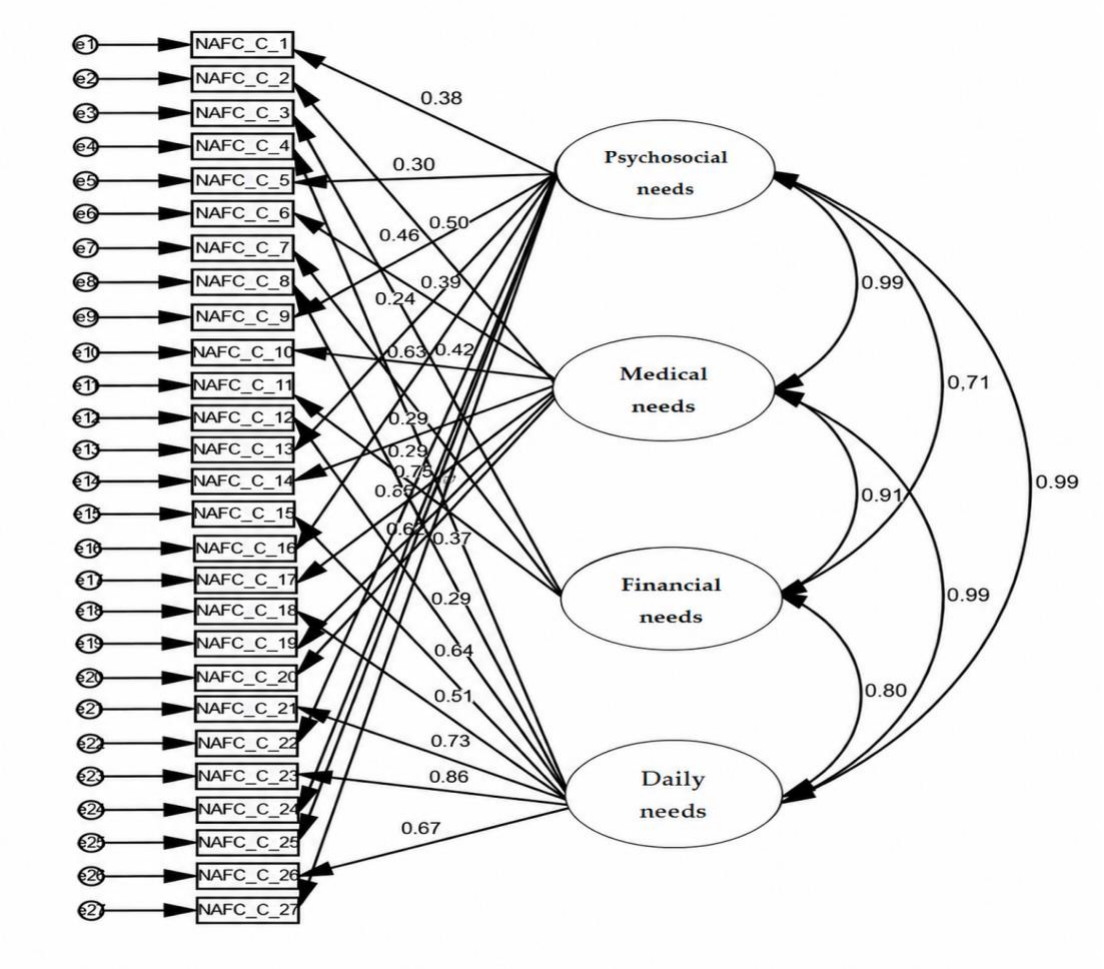


Figure 1. Confirmatory factor analysis of the NAFC-C.

Table 3 presents the correlation coefficients between the four factors in the confirmatory factor analysis.

Strong positive correlations were observed between all factors.

Although a very high correlation was observed between psychosocial and medical unmet needs (r=0.99), the four-factor model was retained as it provided an excellent fit to the data and aligns with the original theoretical framework of the instrument.

Table 3. Correlation coefficients between the four factors in CFA for the NAFC-C.

Factors	Unmet needs		
	Medical	Financial	Daily
Psychosocial unmet needs	0.99 (p<0.001)	0.91 (p<0.001)	0.80 (p<0.01)
Medical unmet needs	-	0.91 (p<0.001)	0.99 (p<0.01)
Financial unmet needs	-	-	0.80 (p<0.01)
Daily unmet needs	-	-	-

Convergent validity

The BCOS questionnaire was used to investigate the convergent validity of the NAFC-C.

The Pearson correlation coefficient was used to investigate the correlations between BCOS and NAFC-C scores (Table 4).

The NAFC-C and its subscales showed statistically significant negative correlations with the BCOS scale.

The total NAFC-C score (r=-0.35, p<0.001) and the Daily unmet needs subscale (r=-0.36, p<0.001) demonstrated moderate inverse relationships.

This indicates that while unmet needs are a significant factor, they account for a specific portion of the variance in caregiver outcomes as measured by the BCOS.

Table 4. Pearson Correlation Coefficients between BCOS and NAFC-C Scores.

Factor	BCOS Correlation Coefficient (r)	p-value
NAFC-C (Total)	-0.35	<0.001
Psychosocial unmet needs	-0.33	<0.001
Medical unmet needs	-0.25	0.01
Financial unmet needs	-0.21	0.04
Daily unmet needs	-0.36	<0.001

Reliability

The reliability of the scale was tested for the characteristics of stability and internal consistency.

Internal Consistency

Internal consistency of the NAFC-C was assessed in the total sample of 100 caregivers, using Cronbach's alpha coefficient (Table 5).

The total scale demonstrated excellent reliability (a=0.894), and all four subscales exceeded the acceptable threshold of 0.6.

However, it is noted that the financial and daily activity subscales showed moderate internal consistency, with values closer to the lower acceptable limit.

Table 5. Cronbach's Alpha Coefficients for the NAFC-C.

Factor	Cronbach's Alpha (α)
NAFC-C (Total Scale)	0.894
Psychosocial unmet needs	0.755
Medical unmet needs	0.718
Financial unmet needs	0.601
Daily unmet needs	0.688

Test-Retest Method

Of the 100 caregivers, 25 completed the questionnaire for a second time (retest) after 3 days.

The ICC values between the initial assessment and reassessment for each item is presented in Table 6.

For the 27 items of the NAFC-C, Spearman correlation coefficients were statistically significant ($p<0.05$) and ranged from 0.51 to 0.95.

Overall, the NAFC-C demonstrated acceptable to high stability.

However, it should be noted that while most items showed strong correlation, four items (4, 11, 18, and 26) yielded lower ICC values (0.51-0.56), indicating moderate stability for these specific needs.

Table 6. Intraclass Correlation Coefficients (ICC) for each NAFC-C item between test and retest.

Item	ICC (test-retest)	95% Confidence Interval	p-value
1	0.81	0.45-0.93	<0.001
2	0.75	0.18-0.91	<0.001
3	0.79	0.23-0.93	<0.001
4	0.53	0.24-0.79	0.02
5	0.83	0.44-0.94	<0.001
6	0.95	0.88-0.98	<0.001
7	0.77	0.29-0.89	<0.001
8	0.84	0.55-0.93	<0.001
9	0.81	0.41-0.89	<0.001
10	0.77	0.22-0.91	<0.001
11	0.56	0.14-0.76	0.011
12	0.91	0.86-0.98	<0.001
13	0.77	0.34-0.86	<0.001
14	0.72	0.32-0.89	<0.001
15	0.81	0.68-0.94	<0.001
16	0.66	0.39-0.89	0.001
17	0.74	0.43-0.91	<0.001
18	0.51	0.24-0.75	0.012
19	0.81	0.44-0.91	<0.001
20	0.83	0.41-0.91	<0.001
21	0.74	0.26-0.87	<0.001
22	0.82	0.65-0.93	<0.001
23	0.77	0.24-0.91	<0.001
24	0.78	0.41-0.92	<0.001
25	0.74	0.23-0.87	<0.001
26	0.55	0.26-0.77	0.011
27	0.74	0.24-0.86	<0.001

Discussion

The primary aim of this study was to translate the NAFC-C into Greek and evaluate its psychometric properties.

Our findings indicate that the Greek version of the NAFC-C is a robust, valid, and reliable instrument for identifying the unmet needs of informal caregivers in the Greek oncology setting.

To date, the psychometric properties of the NAFC-C have not been thoroughly evaluated. Initially, it was created and validated with a Caucasian sample in the United States of America [21].

Then the original English version was validated in a diverse Asian population that included Chinese (68%), Malay (20.4%), and Indians (7.9%) [22].

Additionally, it was culturally adapted and validated in Chinese [23] and translated into Arabic, but it has not yet been fully psychometrically validated [24].

The reliability of the Greek version of the NAFC-C is consistent with international

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research, demonstrating its stability across diverse populations.

In the present study, the Greek total scale showed high internal consistency with a Cronbach's alpha of 0.894, and subscale values ranging from 0.601 to 0.755.

The lower internal consistency observed in the financial and daily activity subscales may be attributed to the heterogeneity of the items within these subscales or the smaller number of items they contain.

These results are comparable to those of the Arabic version used in Oman [24], which reported a total Cronbach's alpha of 0.91 and subscales ranging between 0.70 and 0.76. Even higher consistency was noted in a study in Shanghai, China, where the total Cronbach's alpha reached 0.965 [23].

While the validation study in an English-speaking Asian population in Singapore showed slightly broader subscale variability (0.56 to 0.86) [22], the overall evidence suggests that the NAFC-C remains a robust and reliable instrument for measuring the unmet needs of cancer caregivers worldwide.

The test-retest reliability was generally strong (ICC up to 0.95), with the exception of a few items that showed moderate stability (around 0.50).

This variation might be attributed to the dynamic nature of oncology care, where certain caregiver needs, particularly those related to specific medical information or immediate psychosocial distress, can fluctuate significantly even over a 3-days period.

The choice of a 3-day interval for test-retest reliability aimed to minimize the likelihood of genuine shifts in caregiver needs, which are frequent in acute oncology settings.

While this short timeframe may increase the risk of recall bias, it ensures that the ICC values reflect the instrument's technical stability rather than clinical fluctuations in the patient's status or the caregiver's environment.

Even so, the high internal consistency found and the strong test-retest reliability further support the instrument's stability over time.

These values are comparable to, and in some cases exceed, those reported in the original validation studies, indicating that the Greek translation maintains high linguistic and conceptual precision.

In addition, no studies were found that evaluated the criterion validity of this scale, as in our study.

The Greek version of the NAFC-C demonstrated a moderate but significant negative correlation with the BCOS.

This moderate strength is consistent with the multidimensional nature of caregiving; while unmet needs significantly impact outcomes, other variables not captured by the NAFC-C, such as preexisting family dynamics or individual resilience, also play a role in shaping the caregiving experience.

This confirms that as the number of unmet needs increases, overall caregiving outcomes decline.

The daily unmet needs subscale showed the strongest inverse relationship with the BCOS, highlighting that the practical, day-to-day burdens of caregiving are among the most significant predictors of negative caregiver outcomes in Greece.

Similarly, other NAFC-C validity studies used the Depression Anxiety Stress Scale (DASS), the ZBI, the Quality-of-Life Index-Cancer Scale (CQOL-C), and found that higher unmet needs were significantly associated with lower quality of life [22].

Also, among family caregivers of cancer patients in Oman, the NAFC-C was correlated with CQOL-C, showing that higher NAFC-C scores were significantly associated with lower quality of life scores, particularly in the psychological and social relationship domains [24].

The proven consistency of these inverse relationships across cultures, in which higher needs consistently predict poorer psychosocial outcomes, further reinforces the construct validity of the NAFC-C as a global tool for cancer research.

The performed CFA in this study confirmed a four-factor structure (psychosocial, medical, financial, and daily unmet needs) with excellent fit for the Greek population.

This is consistent with the original development of the tool, which also identified these key dimensions of caregiving needs [21].

Our results align with the validation studies conducted in Asian populations [22,23], reinforcing the cross-cultural stability of the NAFC-C framework.

However, we observed particularly strong positive correlations between factors, especially between psychosocial and medical unmet needs.

Nevertheless, the exceptionally strong correlation between psychosocial and medical unmet needs warrants careful interpretation.

While this could statistically suggest conceptual overlap, in the context of Greek oncology care, it likely reflects the 'symbiotic' nature and strong bond of the caregiver-patient relationship.

In Greece's family-oriented culture, the family takes full responsibility for supporting patients with cancer [31].

The caregiver does not view the patient's medical condition objectively or from a distance; rather, the caregiver feels the patient's physical suffering.

Eventually, the patient's medical crisis becomes the caregiver's psychological crisis, making it difficult to address one without the other [4,32].

However, maintaining psychosocial and medical unmet needs as separate factors is clinically vital, as it allows healthcare providers to design interventions that address both the clinical management of the disease and the emotional support of the family unit.

Although the high inter-factor correlations might suggest that a simpler or unidimensional structure model could fit the data, the four-factor structure was retained to preserve the theoretical integrity of the NAFC-C and to ensure clinical utility.

In oncology, even when needs are highly concurrent, identifying specific areas of needs is vital for developing targeted multidimensional care plans.

Also, the high inter-factor correlations (up to 0.99) were carefully monitored for potential multicollinearity.

However, the excellent fit of the four-factor model in the CFA (CFI=0.944, RMSEA=0.043) indicates that the instrument's structure remains robust and that each factor contributes unique clinical information despite the high degree of overlap in the Greek oncology context.

Regarding discriminant validity, we must note that although high inter-factor correlations were observed, particularly between psychosocial and medical needs, the distinctiveness of the four dimensions is empirically supported by the CFA fit indices.

The fact that the four-factor model outperformed simpler structures indicates that these domains, while highly concurrent in the Greek oncology setting, represent theoretically and clinically unique areas of assessment.

This aligns with the original scale's intent to provide a granular diagnostic profile of caregiver needs.

It is essential to recognize that cultural background significantly shapes how both patients and caregivers perceive and report their needs [33].

Culture includes the ideas, customs, social behaviors, attitudes, and traits of a specific social group, which in turn affect individuals' beliefs about cancer.

Additionally, these beliefs are influenced by various economic, social, and health-related factors, which shape the report and the types of needs [34].

Therefore, when using tools like the NAFC-C, healthcare professionals must consider these cultural influences, as the willingness to disclose unmet needs-particularly psychosocial or financial ones-may vary significantly across different cultural backgrounds.

Strenghts and Limitations

This study is unique because it provides the first validated tool specifically designed to evaluate the needs, rather than just the burden, of Greek cancer caregivers.

While previous research in Greece has utilized the ZBI and BCOS scales, these focus on the impact of caregiving rather than specific gaps in support.

Given that informal caregivers in Greece are a vital but often overlooked part of the healthcare system with limited social, and financial support [19,35], the NAFC-C enables oncology professionals to move beyond general observations and identify specific areas for intervention, such as financial guidance or medical education.

The primary strength of this study is its rigorous methodological approach to scale validation.

By utilizing the forward-backward translation method, we ensured conceptual equivalence between the original English scale and the Greek version.

Additionally, advanced statistical techniques, confirmed an excellent model fit for the four-factor structure in the Greek population.

The inclusion of both internal consistency (Cronbach's alpha) and stability testing (test-retest reliability) further reinforces the scientific robustness of the findings.

Despite strong psychometric results, the study has certain limitations.

The sample size was relatively small from a single tertiary anticancer hospital in Athens, which may limit the generalizability of the

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findings to the broader cancer caregiver population.

Also, the small sample resulted in an item-to-participant ratio lower than the ideal 1:10.

However, the robustness of the fit indices and the high internal consistency suggest that the four-factor structure is stable and culturally relevant.

Then, at the test-retest, the 3-day retest interval, while necessary to capture stability in a dynamic clinical environment, represents a limitation as it may have introduced recall bias.

Furthermore, the use of a convenience sample may introduce selection bias, as caregivers who were more willing to discuss their needs or those with more manageable caregiving schedules might be overrepresented.

This could potentially influence the reported levels of unmet needs compared to the broader caregiver population who declined participation due to high burden or time constraints.

Another statistical limitation of this validation study is the exceptionally high inter-factor correlation observed between certain dimensions, particularly between psychosocial and medical unmet needs (r=0.99).

While such high collinearity can often suggest structural redundancy or lack of item distinctiveness in broader psychometric evaluations, it is interpreted here as a reflection of the deep symbiotic nature of the caregiver-patient relationship inherent to the Greek oncology framework.

In this family-oriented healthcare setting, a patient's clinical crisis deeply dictates the primary caregiver's emotional reality, causing these needs to cluster systematically.

Although a unidimensional model was considered, the original four-factor structure was empirically retained.

This decision is robustly defended by the absolute fit indices ($\chi 2/df=1.182$, RMSEA=0.043) which demonstrate that the model leaves virtually no unexplained variance despite the smaller sample size.

Retaining these distinct dimensions, even with high concurrent overlap, is critical to preserve the clinical granularity required for targeted supportive care interventions.

Nonetheless, future studies with larger cohorts should utilize nested model comparisons to further evaluate model parsimony across different stages of the cancer trajectory.

Additionally, the moderate internal consistency of certain subscales suggests that these dimensions should be used as part of a comprehensive assessment rather than as standalone indicators.

Finally, the study used an observational, cross-sectional, nonrandomized design, offering only a snapshot in time rather than tracking how caregiver needs might evolve throughout the progression of the patient's cancer.

Implications for Clinical Practice

The validation of the Greek NAFC-C provides oncology nurses and healthcare professionals with a practical, evidence-based tool for routine clinical assessment.

Instead of relying on intuitive observations of caregiver distress, they can now use the NAFC-C to screen for specific unmet needs at the point of care.

For example, a high score in the medical needs subscale can trigger an immediate educational intervention by the nursing staff, while high financial or daily activity scores can prompt a referral to social services.

Furthermore, by identifying the symbiotic link between medical and psychosocial needs, the tool encourages a shift toward family-centered care, where the caregiver is treated as a co-recipient of support rather than just a provider of care.

Regarding research, the NAFC-C establishes a standardized metric that allows for the comparison of Greek data with international populations.

Future longitudinal studies can utilize the NAFC-C to track how unmet needs evolve from the time of diagnosis through treatment and into the palliative or survivorship phases.

Additionally, researchers can use this tool to evaluate the effectiveness of targeted interventions.

Finally, the high inter-factor correlations observed in this study open a new avenue for research into the cultural clustering of needs in Mediterranean populations, inviting further exploration of how family dynamics influence the perception of unmet needs.

Conclusions

In conclusion, the Greek version of the NAFC-C is a reliable and valid instrument for evaluating the multifaceted needs of informal caregivers of cancer patients.

The analysis demonstrated high internal consistency and strong construct validity, confirming that the tool accurately measures the

psychosocial, medical, economic, and functional pressures faced by this population.

Overall, the validation of the NAFC-C in Greek will have significant implications for both clinical practice and future research.

The validation of the NAFC-C in Greek does not merely add a new tool to the literature; it introduces a paradigm shift in how caregiver support is conceptualized in Greece, moving from general empathy for the burdened caregiver to specific, evidence-based interventions for the underserved family unit.

Oncology healthcare professionals can now use a scientifically backed scale to identify the specific unmet needs of family caregivers, who are often overlooked in cancer care.

Identifying these gaps allows for the development of targeted support services and interventions. In research, this scale provides a standardized method to measure caregiver burden and outcomes in future studies within the Greek healthcare system.

Ultimately, implementing this scale in oncology settings could help bridge the gap in caregiver support and enhance the overall quality of care for both patients and their families.

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Author Contributions

VS: Data curation, Formal analysis, Investigation; IT: Methodology, Formal analysis, Software, Visualization, Writing-original draft, Writing-review & editing; MM: Writing-original draft, Writing-review & editing; NS: Conceptualization, Writing-original draft, Writing-review & editing; OG: Conceptualization, Methodology, Project administration, Supervision, Writing-original draft, Writing-review & editing; TIK: Conceptualization, Methodology, Project administration, Supervision, Writing-original draft, Writing-review & editing.

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Conflicts of interest

The authors declare that no potential conflicts of interest exist with respect to the research, authorship, and/or publication of this article.

Institutional Review Board

The research was conducted in accordance with bioethical principles, following the Declaration of Helsinki and Greek legislation regarding the protection of individual rights and personal data. The research was performed after granted approval by the General Oncology Hospital of Kifisia, Agioi Anargyroi (protocol number 821/September 9th 2024).

Consent Statement

All participants received full oral and written information regarding the purpose and procedures of the research, their rights, and the voluntary nature of participation.

They signed an informed consent form and then completed the questionnaires.

The anonymity and confidentiality of the data were ensured by coding the questionnaires and storing the files in a secure environment with access exclusively by the researcher.

No sensitive data were collected that could lead to the identification of the participants.

Data availability

Data are available upon reasonable request due to privacy, ethical, and legal restrictions associated with human subject questionnaire data.

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