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Cumulative chemotherapy exposure and social isolation as correlates of caregiver burden and anxiety among family caregivers in outpatient oncology: a cross-sectional study

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Abstract

Background

Family caregivers are recognised as part of the unit of care in supportive and palliative oncology, yet caregiver distress arising during active anticancer treatment remains poorly characterised. We evaluated caregiver burden and clinical anxiety among family caregivers attending an outpatient chemotherapy unit and identified their independent correlates.

Methods

Cross-sectional observational study at a tertiary comprehensive oncology centre in İzmir, Türkiye, between October 2025 and May 2026. Adult primary informal caregivers of patients receiving active cytotoxic chemotherapy were screened consecutively in outpatient chemotherapy waiting units. Burden was measured with the Zarit Burden Interview and anxiety with the 21-item Beck Anxiety Inventory, both validated in Turkish. Bivariate analyses used Spearman correlation, Mann–Whitney U and Kruskal–Wallis tests, and two multivariable linear regression models identified independent correlates of burden and anxiety. Reporting follows the STROBE statement.

Results

Of 634 caregivers invited, 494 (77.9%) returned complete questionnaires and were analysed (55.9% female; mean age 46.32 ± 13.64 years). Mean burden score was 22.62 ± 16.04 and mean anxiety score 11.78 ± 10.65; the two were strongly correlated ($\rho = 0.652$, $p < 0.001$). Cumulative chemotherapy exposure was the strongest independent correlate of both burden ($B = 3.876$, 95% CI 2.92 to 4.83, $p < 0.001$) and anxiety ($B = 2.318$, 95% CI 1.64 to 2.99, $p < 0.001$). Having an active social support network was independently associated with lower burden ($B = -5.948$, 95% CI −8.47 to −3.43, $p < 0.001$). Male sex was associated with lower anxiety than female sex ($B = -2.919$, $p = 0.001$), whereas co-residence with the patient ($B = 2.436$, $p = 0.029$) and more frequent acute hospitalisations ($B = 0.830$, $p = 0.011$) were associated with higher anxiety. The models explained 29.0% and 19.1% of variance respectively.

Conclusions

Caregiver burden and anxiety tracked cumulative active treatment exposure more closely than time elapsed since diagnosis. Social isolation, co-residence, female sex and frequent acute hospitalisations marked a higher-risk caregiver profile. These cross-sectional associations are hypothesis-generating and support routine caregiver distress screening in outpatient oncology as an early supportive and palliative care intervention; prospective studies are required to establish causal pathways.

Background

Despite substantial technological and pharmacological progress, cancer remains one of the most pressing global public health challenges. The diagnosis and treatment of malignancy threaten not only the patient's physical integrity but also trigger a psychosocial crisis that extends across the immediate social network. At the centre of that crisis are informal caregivers, often described in oncology practice as the "hidden patients" [1, 2]. Assuming responsibility for a person with cancer entails a multidimensional burden encompassing complex treatment schedules, symptom management, hospital transportation and escalating financial strain [2, 13]. This chronic and demanding process frequently leads caregivers to neglect their own physical and mental wellbeing, predisposing them to caregiver burden and to psychiatric morbidity, predominantly clinical anxiety [13, 14].

Contemporary definitions of palliative care place the family caregiver within the unit of care alongside the patient, and international guidance increasingly recommends that supportive and palliative care be integrated early in the disease trajectory rather than reserved for the terminal phase [3, 17]. In practice, however, caregiver-directed assessment and support are still concentrated in specialist palliative care and end-of-life settings [16]. The outpatient chemotherapy unit is where most caregivers of patients with cancer spend the greatest number of contact hours with the health system, and it therefore represents an under-used point of access for identifying caregivers with unmet supportive and palliative care needs long before referral to a specialist palliative service.

The period of active chemotherapy is one of the most dynamic, unpredictable and stressful phases of the oncological trajectory. While patients are closely monitored for acute toxicity and treatment response, their accompanying relatives are exposed to a high cognitive and emotional load within the intense atmosphere of the waiting area [5]. Caregiver burden—frequently measured with the Zarit Burden Interview [6], validated for the Turkish population [7]—and clinical anxiety—measured with the Beck Anxiety Inventory [8], also validated in Turkish [9]—are closely linked to the sociodemographic characteristics of both patients and caregivers [4, 15]. Studies examining the independent associations of disease-specific clinical parameters, such as cumulative treatment exposure and acute hospitalisation frequency, with caregiver psychological outcomes in large samples nevertheless remain scarce [15, 16]. Structural factors including educational background, living arrangements and perceived social support represent critical yet under-investigated domains for personalised supportive care [3, 16, 17].

To address these gaps, this study evaluated caregiver burden and anxiety among relatives of patients undergoing active chemotherapy, examined the correlation between these two constructs, and analysed the independent cross-sectional associations of sociodemographic and disease-specific clinical variables using culturally validated instruments [7, 9]. Given the cross-sectional design, the study does not aim to establish causal directionality; rather, we hypothesised that active clinical treatment milestones and structural support systems would show stronger independent associations with caregiver distress than baseline chronological or socioeconomic variables.

Methods

Study design and setting

This cross-sectional observational study was conducted at İzmir City Hospital, a tertiary comprehensive oncology centre in İzmir, Türkiye. Data collection ran from October 2025 to May 2026 in outpatient chemotherapy waiting units.

Participants

Adult informal caregivers accompanying patients receiving active cytotoxic chemotherapy were screened consecutively. Inclusion criteria were: age ≥ 18 years; literacy in Turkish; voluntary participation; acting as the primary informal caregiver for at least 1 month; and accompanying a patient receiving active cytotoxic chemotherapy. Exclusion criteria were a known history of major psychiatric disorder, severe cognitive impairment, or neurodegenerative disease.

Of 634 caregivers invited, 140 (22.1%) were excluded because of incomplete data: incomplete demographic profile (n = 62), missing Zarit Burden Interview items (n = 48) and missing Beck Anxiety Inventory items (n = 30). Final analyses were restricted to the 494 caregivers with complete questionnaires. A complete-case approach was adopted to preserve internal validity and to avoid potential imputation bias. Participant flow is shown in Fig. 1.

Data collection instruments

Data were gathered using a sociodemographic and clinical form together with two validated scales (Additional file 1).

Sociodemographic and clinical form

This form captured caregiver data (age, sex, marital status, education, monthly income, co-residence, secondary dependents, mode of hospital transportation and relationship to the patient). Perceived social support was captured as a binary variable using a single dichotomous item (Yes/No) asking whether the caregiver routinely received active practical assistance from other family members or friends. This single-item approach was adopted to minimise respondent burden in the time-constrained environment of the waiting area. Patient variables comprised age, sex, primary cancer type, caregiving duration, chemotherapy frequency, cumulative chemotherapy exposure and the number of cancer-related hospitalisations.

Zarit Burden Interview

Caregiver burden was quantified using the 19-item Zarit Burden Interview [6], culturally validated for the Turkish population [7]. Items are scored on a 5-point Likert scale (0 = never to 4 = nearly always); total scores range from 0 to 76.

Beck Anxiety Inventory

Caregiver anxiety severity was assessed with the 21-item Beck Anxiety Inventory [8], validated in Turkish [9]. Items are rated on a 4-point Likert scale (0 = not at all to 3 = severely); total scores range from 0 to 63.

Statistical analysis

Analyses were performed in Python 3.11 using pandas, numpy, scipy.stats and statsmodels. The Kolmogorov–Smirnov test indicated non-normal distributions for both burden ($D = 0.115$, $p < 0.001$) and anxiety ($D = 0.141$, $p < 0.001$) scores, and non-parametric methods were therefore used for bivariate analyses.

Bivariate associations were assessed using Spearman's rank correlation for continuous and ordinal variables, the Mann–Whitney U test for binary group comparisons, and the Kruskal–Wallis H test for multi-category variables. To identify independent correlates of caregiver distress, two separate multivariable linear regression models were fitted with total burden and total anxiety scores as dependent variables. Both models simultaneously included caregiver sex, caregiver age, marital status, caregiver education (entered as an ordinal trend, 1–4, with master's and PhD collapsed into a single postgraduate category because of small cell sizes), monthly income (entered as an ordinal trend, 1–6), co-residence with the patient, perceived social support, patient age, caregiving duration since diagnosis, cumulative chemotherapy exposure and number of acute cancer-related hospitalisations. All covariates showed a variance inflation factor below 2.0, indicating no problematic multicollinearity.

For social support, the reference category was the absence of an active support network; for sex, the reference category was female. Unstandardised regression coefficients (B) with 95% confidence intervals are reported throughout. Statistical significance was set at two-tailed $p < 0.05$.

Reporting

The manuscript was prepared in accordance with the STROBE reporting guideline for cross-sectional studies. The completed checklist is provided as Additional file 3.

Results

Sociodemographic and clinical characteristics

Baseline characteristics are shown in Table 1 and in Figs. 2 and 3. Mean caregiver age was 46.32 ± 13.64 years (range 18–75); 276 (55.9%) were women and 218 (44.1%) men. Most were married (n = 379,

76.7%), and 424 (85.8%) were first-degree relatives or spouses of the patient. Regarding education, 185 (37.4%) had primary school education, 175 (35.4%) had completed high school, 122 (24.7%) held a university degree, and 12 (2.4%) held a postgraduate qualification (master's n = 10; PhD n = 2). Because of the small postgraduate cell size, master's and PhD were collapsed into a single postgraduate category for regression purposes, giving a four-level ordinal education variable. Monthly income at the level of the minimum wage was reported by 310 (62.8%) caregivers.

Mean patient age was 61.22 ± 11.10 years (range 26–84); 271 (54.9%) were women. Most caregivers lived with the patient (n = 396, 80.2%). A private vehicle was the predominant mode of transport to hospital (n = 305, 61.7%)

Caregiving profile

Over half of the caregivers performed caregiving tasks entirely alone (n = 255, 51.6%), while 239 (48.4%) reported receiving external assistance (Fig. 4a). Mean caregiving duration since diagnosis was 12.39 ± 19.65 months. The most common chemotherapy schedule was every 14 days (n = 244, 49.4%). Half of the patients had a cumulative chemotherapy exposure of 0–3 months (n = 250, 50.6%), whereas 99 (20.0%) had been treated for 12 months or longer. Acute cancer-related hospitalisation was absent in 178 (36.0%) patients, while 37 (7.5%) had experienced five or more hospitalisations.

Primary oncological diagnoses are presented in Table 2. Colon cancer was the most common (n = 121, 24.5%), followed by breast cancer (n = 94, 19.0%) and lung cancer (n = 66, 13.4%).

Scale descriptive statistics

Burden scores averaged 22.62 ± 16.04 (median 18.0). Anxiety scores averaged 11.78 ± 10.65 (median 9.0; range 0–63). Both distributions deviated significantly from normality (Kolmogorov–Smirnov: burden $D = 0.115$, $p < 0.001$; anxiety $D = 0.141$, $p < 0.001$).

Bivariate associations

Caregiving duration was positively correlated with burden ($\rho = 0.380$, $p < 0.001$) and anxiety ($\rho = 0.285$, $p < 0.001$). Cumulative chemotherapy exposure showed stronger associations with burden ($\rho = 0.463$, $p < 0.001$) and anxiety ($\rho = 0.375$, $p < 0.001$). Cancer-related hospitalisation frequency correlated positively with burden ($\rho = 0.252$, $p < 0.001$) and anxiety ($\rho = 0.248$, $p < 0.001$). Burden and anxiety scores were strongly correlated with each other ($\rho = 0.652$, $p < 0.001$). Bivariate findings are summarised in the correlation heatmap (Fig. 5).

Group comparisons

Caregivers without external social support reported significantly higher burden (25.66 ± 17.06 vs 19.36 ± 14.20; $U = 23{,}987.5$, $p < 0.001$) and higher anxiety (12.80 ± 10.93 vs 10.69 ± 10.26; $U = 26{,}625.5$, $p = 0.015$). Co-residence was associated with higher anxiety scores (12.21 ± 10.73 vs 10.03 ± 10.21; U =

21,882.0, p = 0.049). Caregiver sex showed no univariate association with either scale (burden p = 0.746; anxiety p = 0.201). Transport modality (private vehicle, n = 305, 61.7%, vs other modalities, n = 189, 38.3%) was not associated with anxiety (11.96 ± 10.38 vs 11.48 ± 11.11; U = 30,411.0, p = 0.303) or burden (23.38 ± 16.09 vs 21.39 ± 15.91; U = 31,160.5, p = 0.129) in univariate analysis. Caregiver education was associated with burden (Kruskal–Wallis H = 10.30, p = 0.035 across the five original categories), with university-educated caregivers reporting the highest scores (26.36 ± 16.64) and primary school graduates the lowest (20.80 ± 15.99); education was not associated with anxiety (Kruskal–Wallis H = 3.58, p = 0.466). Cumulative chemotherapy exposure showed strong group differences for both burden (H = 110.40, p < 0.001) and anxiety (H = 73.53, p < 0.001), with burden scores rising systematically from 16.09 ± 12.34 in the 0–3 month group to 33.35 ± 16.49 in the ≥ 12 month group.

Independent correlates of caregiver burden

The burden model was statistically significant (F(11,482) = 17.92, p < 0.001) and explained 29.0% of the variance (R^2 = 0.290, adjusted R^2 = 0.274). Cumulative chemotherapy exposure showed the strongest association (B = 3.878, 95% CI 2.93 to 4.83, p < 0.001). Having an active social support network was independently associated with lower burden scores (B = −5.958, 95% CI −8.48 to −3.44, p < 0.001). A higher hospitalisation count (B = 1.461, 95% CI 0.56 to 2.36, p = 0.002), older patient age (B = 0.177, 95% CI 0.06 to 0.30, p = 0.003) and higher caregiver educational attainment (B = 2.324, 95% CI 0.65 to 4.00, p = 0.007) were also independently associated with higher burden (Table 3; Fig. 6).

Independent correlates of caregiver anxiety

The anxiety model was statistically significant (F(11,482) = 10.31, p < 0.001) and explained 19.1% of the variance (R^2 = 0.191, adjusted R^2 = 0.172). Cumulative chemotherapy exposure remained the strongest correlate (B = 2.317, 95% CI 1.64 to 2.99, p < 0.001). Male sex was independently associated with lower anxiety scores than female sex (B = −2.923, 95% CI −4.73 to −1.12, p = 0.002). Co-residence with the patient (B = 2.426, 95% CI 0.23 to 4.62, p = 0.030) and hospitalisation frequency (B = 0.831, 95% CI 0.19 to 1.47, p = 0.011) were also independently associated with higher anxiety (Table 3; Fig. 6). Having an active social support network was associated with lower anxiety in univariate analysis (12.80 ± 10.93 vs 10.69 ± 10.26; U = 26,625.5, p = 0.015) but this association was substantially attenuated and no longer significant once cumulative chemotherapy exposure was included in the model (B = −1.197, 95% CI −2.99 to 0.59, p = 0.189), consistent with caregivers of patients on longer cumulative treatment being somewhat less likely to report an active support network (Spearman ρ = −0.109, p = 0.015).

Secondary household dependents (present in 81 caregivers, 16.4%) were not associated with burden (25.33 ± 18.02 vs 22.08 ± 15.59; U = 18,373.5, p = 0.161) or anxiety (12.93 ± 10.58 vs 11.55 ± 10.67; U = 18,292.0, p = 0.182) in univariate analysis and were not included in the multivariable models.

Individual scale items and the full correlation matrices are provided in Additional file 2.

Table 1 Sociodemographic and clinical characteristics of caregivers and patients (N = 494)

Characteristic	n (%) or mean ± SD
Caregiver	
Age, years	46.32 ± 13.64 (range 18–75)
Female	276 (55.9)
Male	218 (44.1)
Married	379 (76.7)
First-degree relative or spouse of patient	424 (85.8)
Education: primary school	185 (37.4)
Education: high school	175 (35.4)
Education: university	122 (24.7)
Education: postgraduate (master's or PhD)	12 (2.4)
Monthly income: minimum wage	310 (62.8)
Monthly income: 1–2 × minimum wage	110 (22.3)
Monthly income: 2–3 × minimum wage	52 (10.5)
Monthly income: 3–4 × minimum wage	5 (1.0)
Monthly income: 4–5 × minimum wage	6 (1.2)
Monthly income: > 5 × minimum wage	11 (2.2)
Patient	
Age, years	61.22 ± 11.10 (range 26–84)
Female	271 (54.9)
Caregiving context	
Co-resident with patient	396 (80.2)
Private vehicle as main transport	305 (61.7)
Caregiving alone, without external assistance	255 (51.6)
Receiving external assistance	239 (48.4)
Caregiving duration since diagnosis, months	12.39 ± 19.65
Chemotherapy every 14 days	244 (49.4)
Cumulative chemotherapy exposure 0–3 months	250 (50.6)
Cumulative chemotherapy exposure ≥ 12 months	99 (20.0)

Characteristic	n (%) or mean ± SD
No acute cancer-related hospitalisation	178 (36.0)
≥ 5 acute cancer-related hospitalisations	37 (7.5)
Caregiving context	
Co-resident with patient	396 (80.2)
Private vehicle as main transport	305 (61.7)
Caregiving alone, without external assistance	255 (51.6)
Receiving external assistance	239 (48.4)
Caregiving duration since diagnosis, months	12.39 ± 19.65
Chemotherapy every 14 days	244 (49.4)
Cumulative chemotherapy exposure 0–3 months	250 (50.6)
Cumulative chemotherapy exposure ≥ 12 months	99 (20.0)
No acute cancer-related hospitalisation	178 (36.0)
≥ 5 acute cancer-related hospitalisations	37 (7.5)

Table 2 Primary oncological diagnoses of patients (N = 494)

Cancer type	n	%
Colon cancer	121	24.5
Breast cancer	94	19.0
Lung cancer	66	13.4
Ovarian cancer	40	8.1
Gastric cancer	27	5.5
Pancreatic cancer	25	5.1
Endometrial cancer	24	4.9
Cervical cancer	20	4.0
Rectal cancer	15	3.0
Prostate cancer	11	2.2
Other malignancies[a]	51	10.3
Total	**494**	**100.0**

[a]Other malignancies (n = 51): renal cell carcinoma (7), hepatocellular carcinoma (6), lymphoma (5), bladder cancer (5), brain tumours (4), cholangiocarcinoma (3), laryngeal cancer (3), multiple myeloma (3), vulvar cancer (3), mesothelioma (2), nasopharyngeal carcinoma (2), gallbladder cancer (2), biliary tract cancer (2), testicular cancer (2), oesophageal cancer (2).

Table 3 Multivariable linear regression models for caregiver burden and caregiver anxiety (N = 494)

Covariate	Burden: B (95% CI)	Burden: p	Anxiety: B (95% CI)	Anxiety: p
Male sex (ref: female)	−1.962 (−4.51 to 0.58)	0.131	−2.919 (−4.73 to −1.11)	0.001
Caregiver age	−0.096 (−0.20 to 0.01)	0.069	0.034 (−0.04 to 0.11)	0.372
Married (ref: single)	1.535 (−1.52 to 4.59)	0.325	0.165 (−2.00 to 2.33)	0.881
Caregiver education (ordinal trend)	2.236 (0.58 to 3.89)	0.008	−0.189 (−1.36 to 0.98)	0.751
Monthly income (ordinal trend)	−0.373 (−1.66 to 0.92)	0.570	0.437 (−0.48 to 1.35)	0.348
Co-residence with patient	2.772 (−0.32 to 5.87)	0.079	2.436 (0.24 to 4.63)	0.029
Active social support network (ref: absent)	−5.948 (−8.47 to −3.43)	< 0.001	−1.190 (−2.98 to 0.60)	0.192
Patient age	0.178 (0.06 to 0.30)	0.003	0.055 (−0.03 to 0.14)	0.197
Caregiving duration since diagnosis	0.006 (−0.07 to 0.08)	0.881	−0.015 (−0.07 to 0.04)	0.580
Cumulative chemotherapy exposure	3.876 (2.92 to 4.83)	< 0.001	2.318 (1.64 to 2.99)	< 0.001
Acute hospitalisation count	1.457 (0.56 to 2.36)	0.001	0.830 (0.19 to 1.47)	0.011
Model fit	$F(11,482) = 17.88$; $R^2 = 0.290$; adjusted $R^2 = 0.274$		$F(11,482) = 10.32$; $R^2 = 0.191$; adjusted $R^2 = 0.172$	

Discussion

In a large sample of family caregivers attending an outpatient chemotherapy unit, caregiver burden and clinical anxiety were strongly co-occurring, with a robust correlation between the two instruments ($\rho = 0.652$, $p < 0.001$). Cumulative active chemotherapy exposure was the strongest independent correlate of both elevated burden (B = 3.878) and elevated anxiety (B = 2.317) in multivariable models. Having an active social support network was independently associated with approximately six fewer burden score units; the corresponding univariate association with anxiety did not persist once cumulative

chemotherapy exposure was accounted for, suggesting the crude anxiety association was partly confounded by treatment exposure. Female sex, co-residence and more frequent hospitalisations were independently associated with elevated anxiety. Higher caregiver educational attainment was associated with greater burden but not with anxiety, while monthly income showed no significant association with either outcome.

The principal strength of this study is its large, consecutively assembled complete-case sample (N = 494), which permitted stable multivariable estimates across a substantial covariate set. The use of culturally validated Turkish instruments [7, 9] and adherence to STROBE reporting standards further support methodological rigour. Important limitations must nevertheless be acknowledged. The cross-sectional design is the most fundamental constraint: all reported associations are cross-sectional, causal direction cannot be established, and reverse causality cannot be excluded—caregivers with higher baseline distress may, for example, disproportionately accompany patients in more intensive treatment phases. Perceived social support was captured with a single binary item, which limits the depth of characterisation relative to validated multidimensional instruments [19]. The exclusion of 22.1% of caregivers because of incomplete questionnaires and recruitment from a single centre may introduce selection bias and limit generalisability. Clinical variables including tumour stage, performance status and line of therapy were not captured, which is likely to account for a substantial proportion of the unexplained variance (R^2 = 0.290 and 0.191) and which also prevents us from distinguishing caregivers of patients receiving treatment with curative intent from those supporting patients on palliative-intent systemic therapy.

Our finding that cumulative chemotherapy exposure was more strongly associated with caregiver distress than overall caregiving duration since diagnosis aligns with prior work suggesting that adaptation to long-term caregiving may be disrupted by the cyclical toxicity and clinical uncertainty of active treatment [4, 15]. The protective association of social support is consistent with the broader supportive care literature [3, 17], although our binary operationalisation is considerably less rigorous than validated instruments such as the Multidimensional Scale of Perceived Social Support [19]. The association between co-residence and anxiety corroborates findings from chemotherapy caregiver studies in which around-the-clock exposure to treatment-related suffering sustains hypervigilance [5, 15]. The higher burden reported by university-educated caregivers is consistent with observations of role conflict and time scarcity among informal carers who remain in employment [11, 18], although we did not measure occupational status or health literacy directly. The absence of an association between monthly income and either scale is consistent with evidence that the psychological burden of cancer caregiving is not straightforwardly moderated by household financial standing [12, 13].

These cross-sectional associations, while not establishing causal pathways, carry preliminary clinical relevance for supportive and palliative care delivery. The emerging risk profile—socially isolated, female caregivers co-residing with patients receiving extended chemotherapy regimens and experiencing frequent acute hospitalisations—provides an empirically informed basis for targeting limited psycho-oncology and palliative care resources within the outpatient chemotherapy setting [1, 5]. Oncology

centres may benefit from integrating systematic caregiver distress screening into these environments, with particular attention to cumulative treatment exposure as a trigger for escalation of support and, where appropriate, for referral to specialist palliative care. Transport modality showed no significant univariate association with anxiety or burden and was not entered into the multivariable models; socioeconomic vulnerability and commuting burden nevertheless merit further investigation with more granular exposure measures as targets for institutional support programmes [10].

Several questions warrant prospective investigation. First, longitudinal cohort studies are needed to model the temporal trajectory of caregiver distress across distinct phases of the chemotherapy cycle, and to establish whether cumulative treatment exposure drives distress escalation or whether pre-existing distress selects for more intensive treatment contexts. Second, future studies should incorporate validated multidimensional social support instruments [19] alongside tumour stage, performance status and treatment intent. Third, interventional studies are required to evaluate structured supportive care pathways—including peer support, psychoeducation and logistical assistance—tailored to the risk correlates identified here. Finally, multicentre studies across different sociocultural and health system contexts are needed to test the generalisability of these findings beyond the present single-centre Turkish sample.

Conclusions

In this cross-sectional sample of 494 family caregivers attending an outpatient chemotherapy unit, caregiver burden and anxiety were more strongly associated with cumulative cytotoxic treatment exposure than with time elapsed since diagnosis. Social isolation emerged as an independent correlate of caregiver burden, while co-residence, female sex and frequent acute hospitalisations were independently associated with caregiver anxiety. These associations do not establish causal pathways, but they offer a preliminary, empirically informed framework for prioritising caregiver distress screening and supportive and palliative care resources for high-risk caregivers in the outpatient oncology setting, pending confirmatory prospective research.

Abbreviations

BAI
Beck Anxiety Inventory
CI
confidence interval
SD
standard deviation
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology
VIF
variance inflation factor

ZBI
Zarit Burden Interview

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki. Ethics approval was granted by the Institutional Ethics Committee of İzmir City Hospital (date: 16/10/2025; decision number: 2025/494). Written and verbal informed consent was obtained from all participants prior to inclusion.

Consent for publication

Not applicable. No individually identifiable personal information is reported.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

EGK conceived and designed the study, collected the data, performed the statistical analysis and drafted the manuscript. HT and OÜÜ contributed to data collection, provided clinical supervision and critically revised the manuscript. YK contributed psychiatric expertise and critically revised the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The fully anonymised dataset generated and analysed during the current study is available in the Zenodo repository under a Creative Commons Attribution 4.0 International licence: https://doi.org/10.5281/zenodo.20381044

References

1. Guerra-Martín MD, Casado-Espinosa MDR, Gavira-López Y, Holgado-Castro C, López-Latorre I, Borrallo-Riego Á. Quality of life in caregivers of cancer patients: a literature review. Int J Environ Res Public Health. 2023;20(2):1570. https://doi.org/10.3390/ijerph20021570
2. Weeratunga E, Goonewardena S, Meegoda L. Predictors of quality of life among informal caregivers of patients with advanced cancer in palliative care: a cross-sectional study. Int J Community Med Public Health. 2026;13(1):128–37. https://doi.org/10.18203/2394-6040.ijcmph20254420
3. Lambert SD, Harrison JD, Smith E, Bonevski B, Carey M, Lawsin C, Paul C, Girgis A. The unmet needs of partners and caregivers of adults diagnosed with cancer: a systematic review. BMJ Support Palliat Care. 2012;2(3):224–30. https://doi.org/10.1136/bmjspcare-2012-000226
4. Karimi Moghaddam Z, Rostami M, Zeraatchi A, Mohammadi Bytamar J, Saed O, Zenozian S. Caregiving burden, depression, and anxiety among family caregivers of patients with cancer: an investigation of patient and caregiver factors. Front Psychol. 2023;14:1059605. https://doi.org/10.3389/fpsyg.2023.1059605
5. Dhumal T, Siddiqui ZA, Kelley GA, Harper F, Kelly KM. Systematic review and meta-analysis of randomized controlled trials of interventions addressing caregiver distress and burden among cancer caregivers. PEC Innov. 2023;2:100145. https://doi.org/10.1016/j.pecinn.2023.100145
6. Zarit SH, Reever KE, Bach-Peterson J. Relatives of the impaired elderly: correlates of feelings of burden. Gerontologist. 1980;20(6):649–55. https://doi.org/10.1093/geront/20.6.649
7. İnci FH, Erdem M. Bakım verme yükü ölçeği'nin Türkçe'ye uyarlanması geçerlilik ve güvenilirliği [Validity and reliability of the burden interview and its adaptation to Turkish]. Atatürk Üniv Hemşirelik Yüksekokulu Derg. 2008;11(4):85–95.
8. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. J Consult Clin Psychol. 1988;56(6):893–7. https://doi.org/10.1037/0022-006X.56.6.893
9. Ulusoy M, Şahin NH, Erkmen H. Turkish version of the Beck Anxiety Inventory: psychometric properties. J Cogn Psychother. 1998;12(2):163–72.
10. Dee EC. Family and caregiver financial toxicity associated with cancer—a global, inequitable, and urgent consideration. JAMA Netw Open. 2023;6(6):e2319317. https://doi.org/10.1001/jamanetworkopen.2023.19317
11. Litzelman K, Berghoff A, Stevens J, Kwekkeboom K. Predictors of psychoneurological symptoms in cancer caregivers over time: role of caregiving burden, stress, and patient symptoms. Support Care Cancer. 2023;31(5):274. https://doi.org/10.1007/s00520-023-07741-3
12. Cui P, Yang M, Hu H, Cheng C, Chen X, Shi J, Li S, Chen C, Zhang H. The impact of caregiver burden on quality of life in family caregivers of patients with advanced cancer: a moderated mediation analysis of the role of psychological distress and family resilience. BMC Public Health. 2024;24(1):817. https://doi.org/10.1186/s12889-024-18321-3

13. Badger T, Segrin C, Crane T, Morrill K, Sikorskii A. Social determinants of health, psychological distress, and caregiver burden among informal cancer caregivers of cancer survivors during treatment. J Psychosoc Oncol. 2024;42(3):333–50. https://doi.org/10.1080/07347332.2023.2248486
14. Luo X, Yang L, Chen J, Zhang J, Zhao Q, Zhu J. Chemotherapy induced nausea and vomiting may cause anxiety and depression in the family caregivers of patients with cancer. Front Psychiatry. 2023;14:1221262. https://doi.org/10.3389/fpsyt.2023.1221262
15. Stenberg U, Ruland CM, Miaskowski C. Review of the literature on the effects of caring for a patient with cancer. Psychooncology. 2010;19(10):1013–25. https://doi.org/10.1002/pon.1670
16. Chan LM, Ng SCJ. Prevalence and correlates of caregiver anxiety in family caregivers of patients with advanced cancer: a cross-sectional study in a palliative care unit in Hong Kong. East Asian Arch Psychiatry. 2022;32(2):27–32. https://doi.org/10.12809/eaap2171
17. Hart NH, Crawford-Williams F, Crichton M, Yee J, Smith TJ, Koczwara B, Fitch MI, Crawford GB, Mukhopadhyay S, Mahony J, Cheah C, Townsend J, Cook O, Agar MR, Chan RJ. Unmet supportive care needs of people with advanced cancer and their caregivers: a systematic scoping review. Crit Rev Oncol Hematol. 2022;176:103728. https://doi.org/10.1016/j.critrevonc.2022.103728
18. Gupta A, Johnson WV, Henderson NL, Ogunleye OO, Sekar P, George M, Breininger A, Kyle MA, Booth CM, Hanna TP, Rocque GB, Parsons HM, Vogel RI, Blaes AH. Patient, caregiver, and clinician perspectives on the time burdens of cancer care. JAMA Netw Open. 2024;7(11):e2447649. https://doi.org/10.1001/jamanetworkopen.2024.47649
19. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The Multidimensional Scale of Perceived Social Support. J Pers Assess. 1988;52(1):30–41. https://doi.org/10.1207/s15327752jpa5201_2

Figures

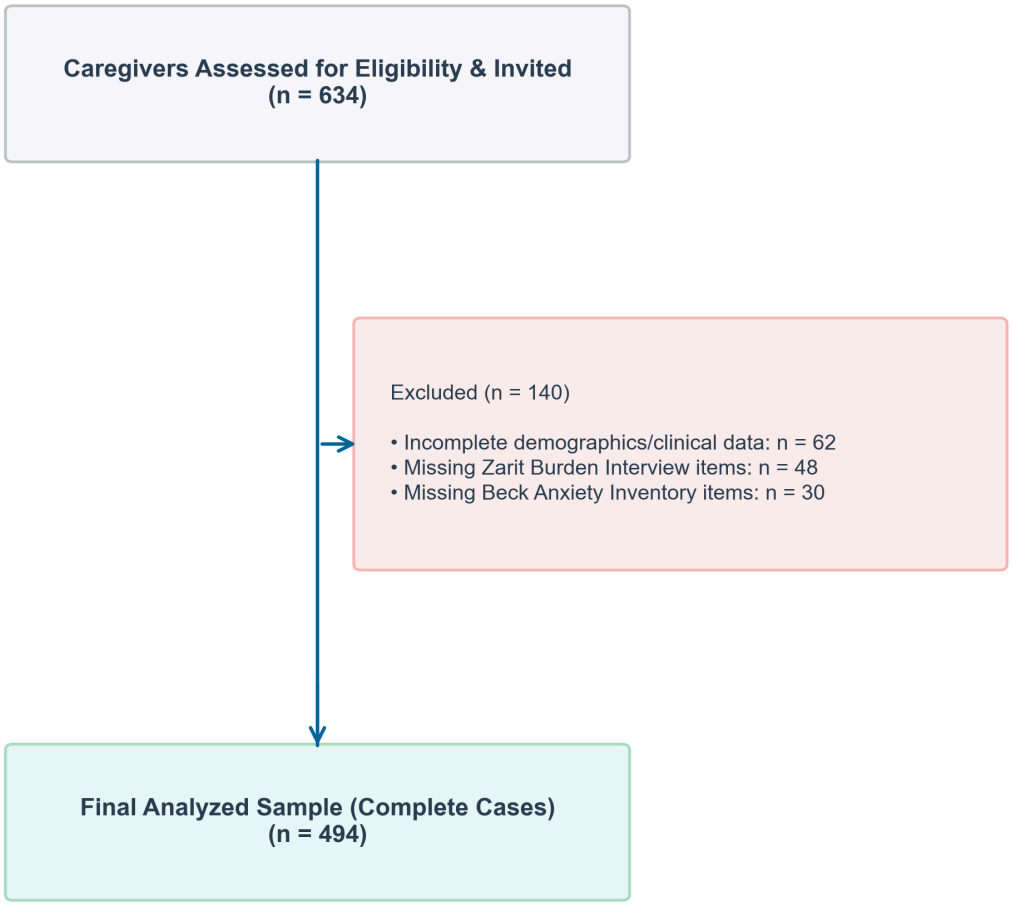


Figure 1

STROBE flow diagram of participant screening, exclusions and final complete-case analysis (N = 494).

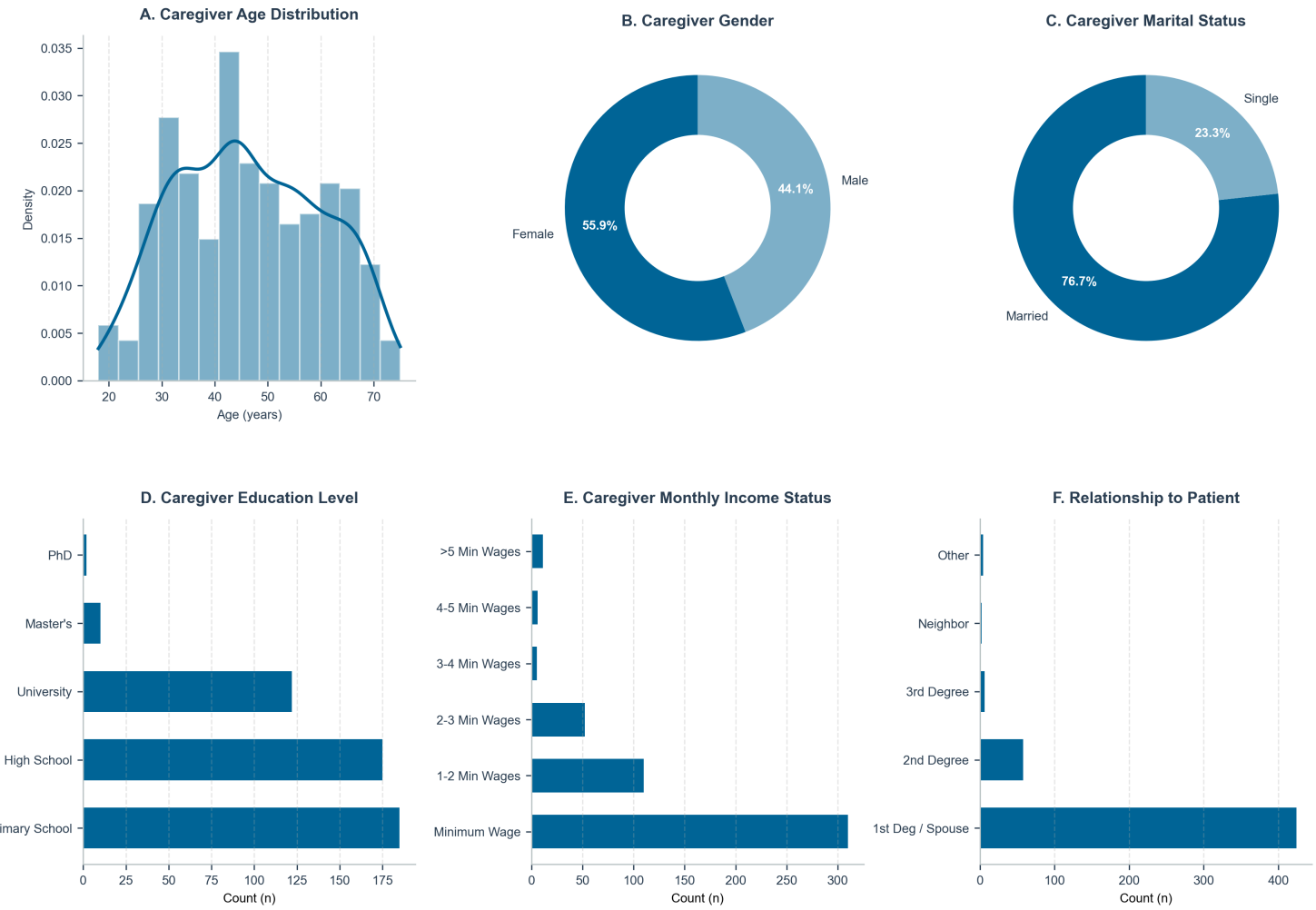


Figure 2

Distribution of caregiver sociodemographic characteristics: (a) age; (b) sex; (c) marital status; (d) educational background; (e) monthly baseline income; (f) relationship to the patient.

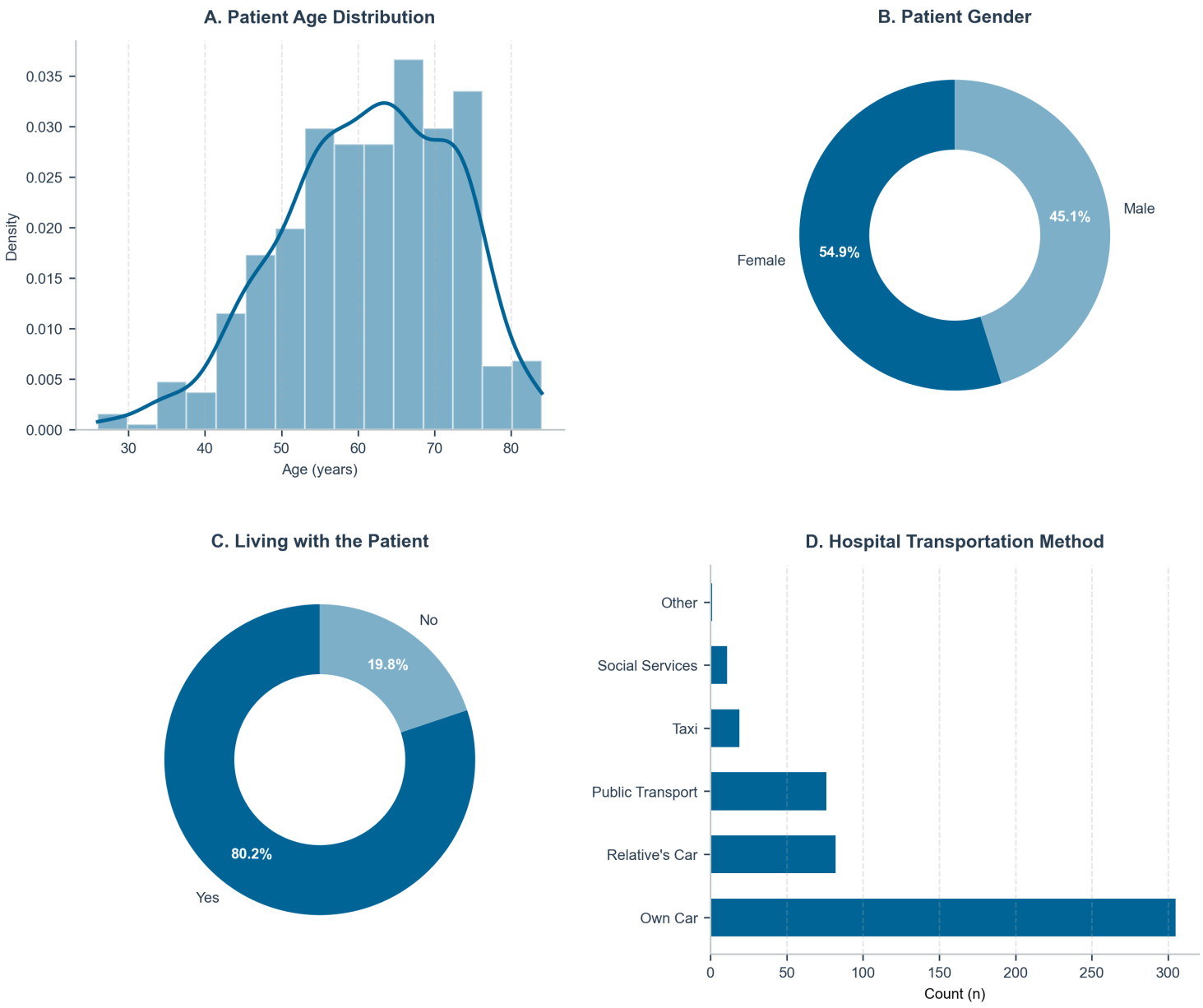


Figure 3

Demographic and logistical profile of the patient cohort: (a) age range; (b) sex; (c) co-residence arrangements; (d) main mode of hospital transport.



Figure 4

Clinical attributes of patient–caregiver dyads: (a) active social support networks; (b) secondary household dependents; (c) caregiving duration since diagnosis; (d) chemotherapy scheduling frequency; (e) cumulative chemotherapy exposure groups; (f) frequency of acute cancer-related hospitalisations.

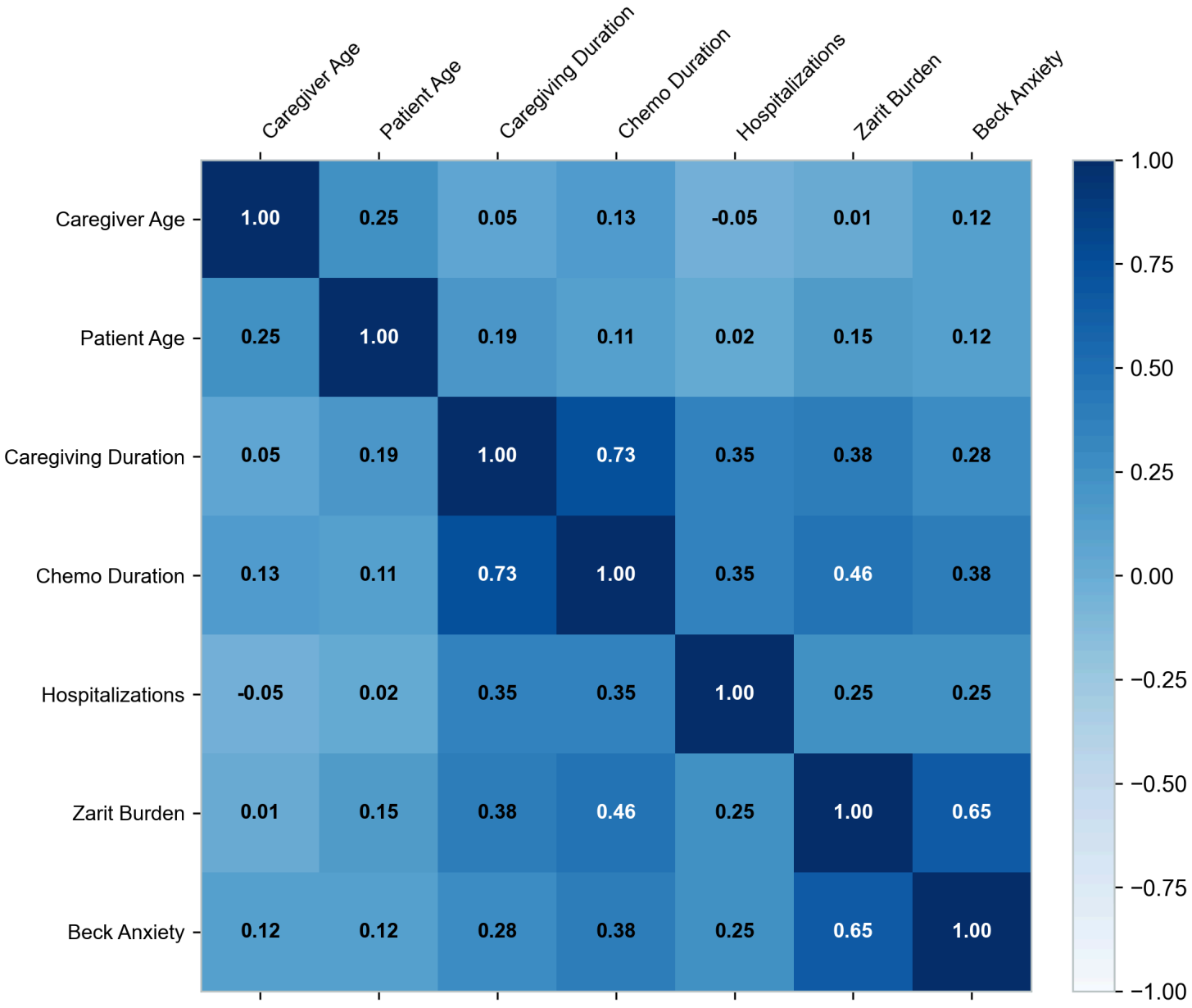


Figure 5

Spearman rank correlation heatmap across psychometric instruments, continuous sociodemographic variables and acute morbidity parameters.

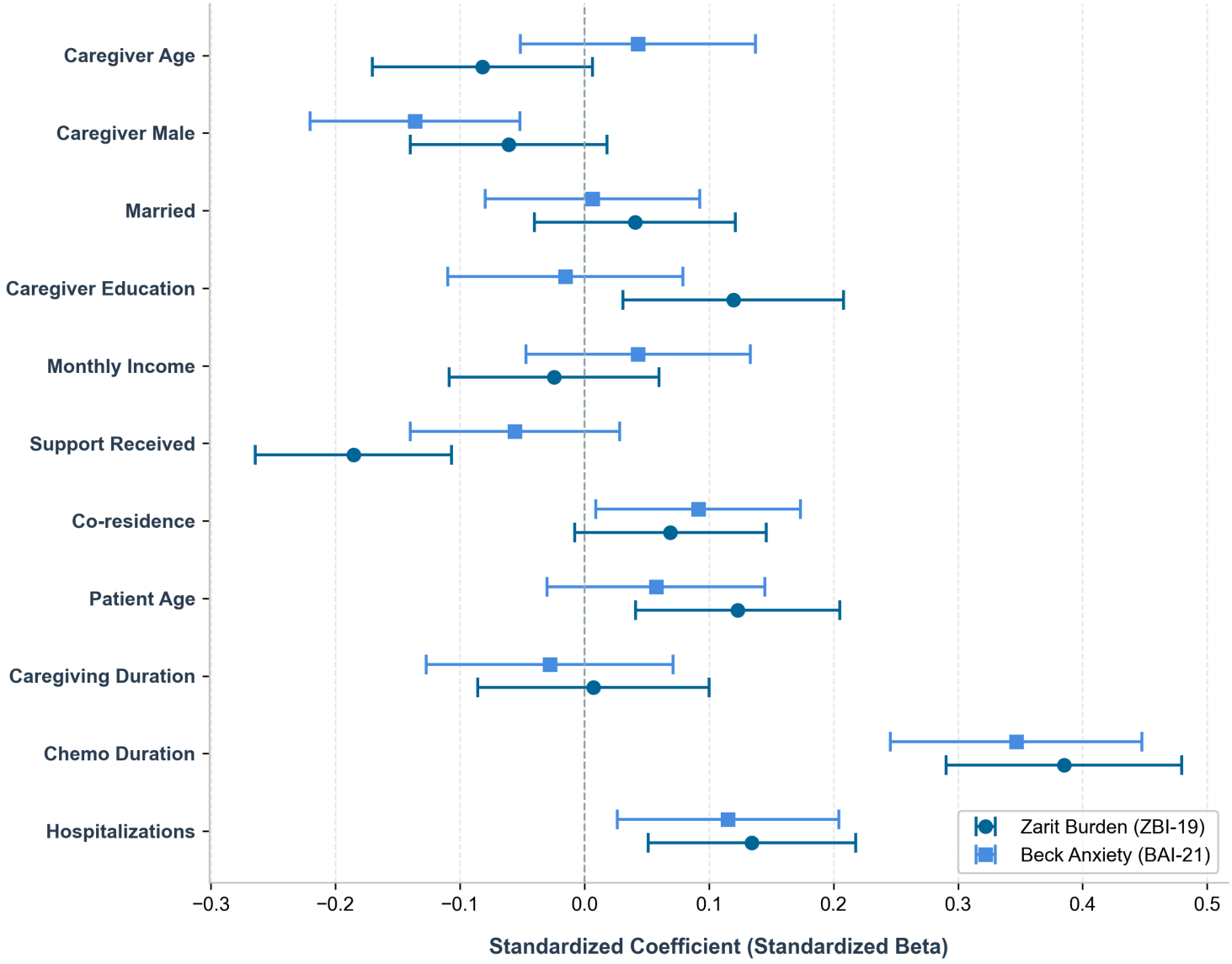


Figure 6

Multivariable linear regression models identifying independent correlates of: total caregiver burden scores; total caregiver anxiety scores. Error bars represent 95% confidence intervals.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- supplementary1.pdf
- supplementary2.pdf
- STROBE.docx