

# Caregiver Depression and Burden are Associated with Poor Functional Outcomes in Older Patients Following Major Abdominal Surgery

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## Abstract

**Aim:** This study aimed to investigate the relationship between caregiver burden and depression in caregivers of older patients undergoing major abdominal surgery and to evaluate its association with the patient's postoperative functional status.

**Methods:** In this cross-sectional study conducted at a single center, we enrolled 65 patient-caregiver dyads. Patient functional status was assessed using the Katz Index and the Lawton-Brody Instrumental Activities of Daily Living Scale (IADL). Caregiver burden was measured with the Zarit Caregiver Burden Scale, and depression was assessed using the Beck Depression Inventory (BDI). Data on event impact (IES-R) and quality of life (SF-36) were also collected. Correlations between variables were evaluated using Spearman's rank correlation coefficient.

**Results:** The study included caregivers with a mean age of  $58.9 \pm 13.8$  years and patients with a mean age of  $70.4 \pm 5.8$  years. More than half of the caregivers (50.8%) exhibited severe depression according to the BDI. A strong positive correlation was found between caregiving burden and depression ( $r = 0.53$ ,  $p < 0.001$ ). Patients with moderately or severely depressed caregivers had significantly lower Katz Index (BADL) and Lawton-Brody (IADL) scores (both  $p < 0.001$ ). Caregiver depression was also associated with lower quality of life on the SF-36 ( $r = -0.31$ ,  $p = 0.013$ ), and caregiver burden showed a moderate positive correlation with Impact of Event Scale (IES-R) scores ( $r = 0.32$ ,  $p = 0.010$ ).

**Conclusions:** Our findings reveal a significant positive relationship between caregiver burden and depression, which in turn is associated with poorer patient functional outcomes. These results underscore the critical need for implementing comprehensive psychological support systems for this vulnerable caregiver population to improve both caregiver and patient outcomes.

**Keywords:** Caregiver burden; depression; general surgery; quality of life

## 1. Introduction

The surgical recovery process in older patients is often more challenging and complex compared to younger individuals. This is primarily due to the age-related decline in physiological reserves, resulting in a reduced tolerance for adverse events. Consequently, this makes postoperative recovery, regaining independence, and returning home after hospital discharge more difficult for older individuals. Advances in surgical and anesthetic techniques have broadened access to surgical procedures for a growing number of older patients, with major abdominal surgeries, such as those for abdominal aortic aneurysm and colorectal cancer, being common interventions in this population. Forty-five percent of individuals aged 65 and older require ongoing care following hospital discharge.<sup>1-3</sup>

Caregivers play a crucial role in the recovery of older patients. Since older patients often require continuous care, the burden on

caregivers increases. This burden is not limited to performing practical tasks; it also includes various areas such as providing emotional support and financial management. These multifaceted challenges can negatively affect both patient recovery and caregiver mental health.<sup>4</sup> Long-term caregivers frequently experience psychological challenges, including emotional burnout and depression. Increased caregiver burden can directly and negatively impact both the patient's overall health and quality of life.<sup>5</sup> Research on caregivers of patients with neurodegenerative diseases, those recovering from major surgery, and individuals with cancer has demonstrated that higher caregiver burden is associated with poorer mental and physical health outcomes for patients. This is often attributed to factors such as emotional contagion and a decline in the quality of care provided.<sup>6-8</sup>

Projections indicate that by 2030, one in six people worldwide will be 60 years or older, with the number of individuals aged 80 and over expected to triple between 2020 and 2050, reaching a total of 426 million.<sup>9</sup> While studies have examined caregiver burden and depression in other surgical contexts, such as liver transplantation where a substantial proportion of caregivers (approximately 60%) experience depressive symptoms, research specifically addressing these issues in caregivers of patients undergoing major abdominal surgery is limited.<sup>10,11</sup>

Therefore, this study aims to explore the caregiving burden and depression levels in relatives of older patients undergoing major abdominal surgery and to evaluate the relationship between these factors and the patients' quality of life.

## 2. Materials and Methods

### 2.1. Study design, setting, and selection of participants

This study enrolled patients aged 65 and older who underwent major abdominal surgery at the Gastroenterology Surgery Clinic of City Hospital, Adana, Türkiye between March and September 2024, along with their family members who identified themselves as caregivers. The study was focused on elective cancer surgeries to minimize heterogeneity in postoperative course and excluded emergency/palliative cases to ensure comparability. For the purposes of this study, "major abdominal surgery" was defined as an intra-abdominal procedure requiring general anesthesia, laparotomy or laparoscopy, typically including colorectal resections for malignancy, gastrectomy and pancreatic resections. Minor procedures (e.g., cholecystectomy, appendectomy, hernia repair) were excluded. Written informed consent was obtained from both patients and caregivers after a thorough explanation of the study's purpose and procedures.

- Inclusion criteria (patients):

*Age ≥65 years.*

*Undergoing elective major abdominal surgery (e.g., gastrointestinal system cancer surgery including colorectal cancer resection, gastrectomy, Whipple surgery).*

*Able to provide informed consent and participate in functional assessments.*

- Exclusion criteria (patients):

*Emergency surgery.*

*Palliative or non-curative procedures.*

*Severe cognitive impairment or communication barrier preventing informed consent or functional assessment.*

*Pre-existing severe functional dependency (Katz Index ≤2).*

*Refusal to participate in the study.*

- Inclusion criteria (caregivers):

*Adult family member (≥18 years) who self-identifies as the primary caregiver during the perioperative period.*

*In daily contact with the patient after hospital discharge.*

- Exclusion criteria (caregivers):

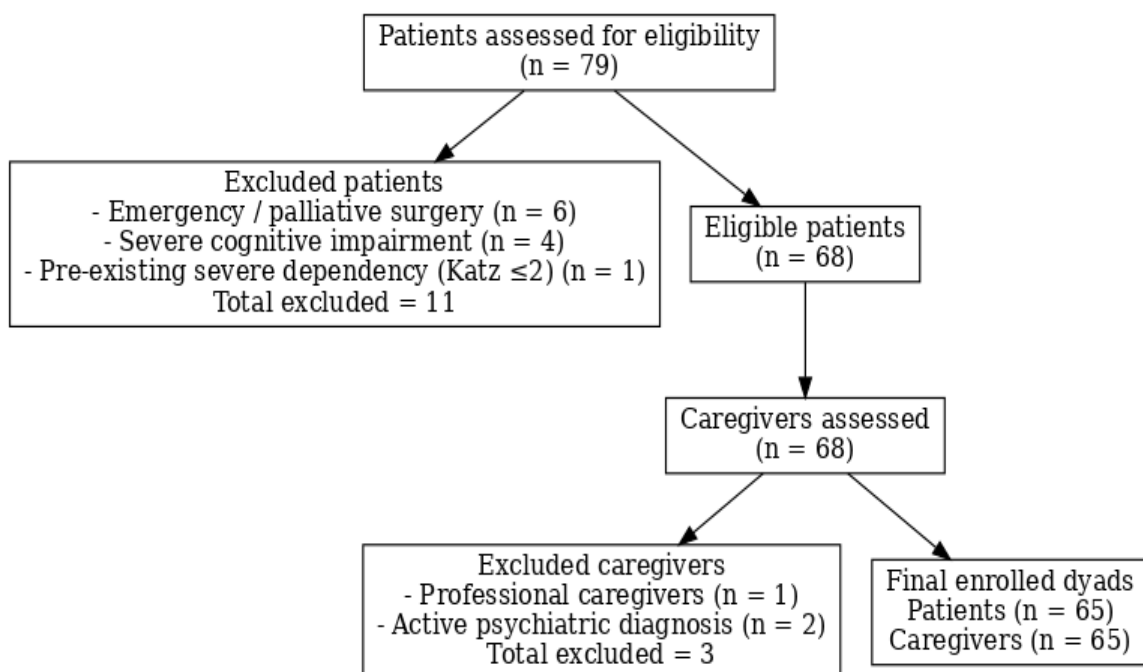
*Professional (paid) caregivers, to avoid bias from non-family care.*

*Individuals with a pre-existing psychiatric diagnosis under active treatment (to reduce confounding of depression assessment).*

*Refusal to participate in the study.*

Patient Flowchart illustrates the inclusion and exclusion of patients and caregivers for the study on caregiver burden and depression in older patients undergoing major abdominal surgery.

### Flowchart



## 2.2. Variables and Data Collection

Data was collected separately for patients and caregivers. Patient data included demographics (age, gender, etc.), time to start oral feeding, length of hospital stay, survival status, local and systemic complications, and functional status. Caregiver data included demographics, impact of the event, caregiving burden, quality of life, and depression levels.

## 2.3. Scales

Patient functional status was assessed using two validated scales:

- **Katz Index of Independence in Activities of Daily Living:** This scale evaluates 6 basic activities of daily living, with scores ranging from 0 (total dependence) to 6 (complete independence).<sup>12</sup>
- **Lawton-Brody Instrumental Activities of Daily Living Scale:** This scale evaluates 8 instrumental activities, with scores ranging from 0 (dependent) to 8 (completely independent).<sup>13</sup> The Katz and Lawton-Brody assessments were performed on patients between 1 and 5 days following the surgical procedure.

Caregiver data was collected using four validated scales:

- **Impact of Event Scale-Revised (IES-R):** This 22-item scale measures levels of stress related to a traumatic event. Total scores range from 0 to 88, with higher scores indicating greater stress and a risk for post-traumatic stress disorder (14).
- **Zarit Caregiver Burden Scale:** Composed of 22 items, this scale measures the perceived burden of caregiving. Total scores range from 0 to 88, with higher scores indicating greater burden.<sup>15</sup>
- **Short Form-36 (SF-36):** This form consists of 8 subscales to measure health and quality of life. Scores range from 0 to 100, with higher scores indicating better health and quality of life.<sup>16</sup>
- **Beck Depression Inventory (BDI):** This 21-item scale assesses the severity of depressive symptoms. Total scores range from 0 to 63, with higher scores indicating more severe depression.<sup>17</sup>

All caregiver questionnaires were administered during the same period as the patient functional assessments, between 1 and 5 days post-surgery.

## 2.4. Statistical analysis

Statistical analyses were performed using IBM SPSS version 26 (IBM Corp., Armonk, NY). Continuous variables are presented as mean  $\pm$  standard deviation or median and interquartile range (IQR, Q1-Q3) as appropriate, while categorical variables are summarized as frequencies (n) and percentages (%). Categorical variables were compared using the chi-square test or Fisher's exact test. The normality of continuous variables was assessed using the Kolmogorov-Smirnov test. Independent samples t-tests were used to compare normally distributed continuous data, while the Mann-Whitney U test was used for non-normally distributed data. Correlations between scales were evaluated using Spearman's rank correlation coefficient. A p-value lower than 0.05 was considered statistically significant.

## 3. Results

A total of 65 patient-caregiver dyads were included in the study. Caregivers had a mean age of  $58.9 \pm 13.8$  years, and patients' mean age was  $70.4 \pm 5.8$  years. Perioperative outcomes: The median length of hospital stay was 6 days (IQR: 5–8). Most patients (n = 55, 84.6%) were discharged directly home with family support, while n

= 4 (6.2%) required temporary inpatient rehabilitation and n = 6 (9.2%) were transitioned to long-term or nursing care facilities. Perioperative mortality occurred in n = 6 patients, all within 30 days of surgery.

Follow-up assessments for functional status and caregiver questionnaires were conducted between postoperative day 1 and day 5 during hospitalization, with survival and discharge disposition recorded up to 30 days postoperatively.

Patient functional outcomes are detailed in Table 1, with median Katz Index score of 5 (IQR: 4–6) and Lawton–Brody score of 5 (IQR: 4–7).

Caregiver assessments showed median IES-R 36 (IQR: 26–50), Zarit 39 (IQR: 25–56), BDI 24 (IQR: 15–35), and mean SF-36 73.9  $\pm$  8.8.

More than half of caregivers (50.8%) exhibited severe depressive symptoms.

## 3.1. Correlations between Scores

A strong positive correlation was observed between caregiving burden (Zarit) and caregiver depression (BDI) ( $r = 0.53$ ,  $p < 0.001$ ). Patient functional status, as measured by the Katz Index, showed strong negative correlations with caregiver burden ( $r = -0.65$ ,  $p < 0.001$ ) and moderate negative correlations with caregiver depression ( $r = -0.48$ ,  $p < 0.001$ ). Similarly, the Lawton–Brody IADL scale exhibited strong negative correlations with both caregiver burden ( $r = -0.71$ ,  $p < 0.001$ ) and caregiver depression ( $r = -0.64$ ,  $p < 0.001$ ). A weak negative correlation was found between caregivers' quality of life (SF-36) and depression levels ( $r = -0.31$ ,  $p = 0.013$ ). The correlations between all scales are presented in Table 2.

## 3.2. Analysis by Caregiver Depression Level

Patients whose caregivers were categorized as moderately or severely depressed had significantly lower Katz Index scores ( $p < 0.001$ ) and Lawton-Brody scores ( $p < 0.001$ ) compared to patients with non-depressed or mildly depressed caregivers. Caregivers with higher levels of depression also exhibited significantly higher Zarit care burden scores ( $p < 0.001$ ). Additionally, a greater proportion of caregivers who were parents was observed in the high depression group ( $p = 0.023$ ), and patients cared for by highly depressed individuals had a higher prevalence of comorbidities ( $p = 0.011$ ). No significant associations were found between caregiver depression and other variables, including caregiver's age, patient's age, duration of hospitalization, time to feeding, ICU stay, caregiver's gender, marital status, education level, patient mortality, post-op delirium, local complications, or ileostomy/colostomy (Table 3).

## 4. Discussion

In this study, we examined the relationship between caregiver burden, caregiver depression, and patients' postoperative functional status in older patients undergoing major abdominal surgery. To our knowledge, this is the first study to specifically investigate these factors among caregivers of older individuals who have undergone major abdominal procedures, providing novel data in this field. By involving 65 patient–caregiver dyads, the study identified significant correlations between caregiver burden, caregiver depression, and patients' postoperative functional status. Consistent with our hypothesis, caregivers experienced high levels of burden, depressive symptoms, and emotional impact, with more than half exhibiting severe depression. To interpret the findings of our study, we must first consider the demographic characteristics of the caregivers, which play an important role in understanding both caregiver burden and its psychological impacts. In our cohort, 66.2% of caregivers were female, with a mean age of  $58.9 \pm 13.8$  years.

**Table 1****Caregiver's and Patient's Characteristics**

<b>Caregiver's characteristics</b>		
Caregiver's Age		58.9±13.8
Impact of Event Scale-Revised – Caregiver		36(26-50)
Zarit – Caregiver		39(25-56)
SF-36 – Caregiver		73.9±8.8
Beck Depression Inventory – Caregiver		24(15-35)
BDI – Caregiver	Minimal/no depression	2(3.1)
	Mild depression	16(24.6)
	Moderate depression	14(21.5)
	Severe depression	33(50.8)
Caregiver's Gender	Male	22(33.8)
	Female	43(66.2)
	Married	52(80)
Caregiver's Marital Status	Single	7(10.8)
	Divorced	6(9.2)
	Illiterate	8(12.3)
	Literate	9(13.8)
Caregiver's education level	Primary School	19(29.2)
	Middle School	12(18.5)
	High School	9(13.8)
	University	8(12.3)
Who's the caregiver?	Partner	43(66.2)
	Parent	20(30.8)
	Child	2(3.1)
<b>Patient's characteristics</b>		
Patient's Age		70.4±5.8
Duration of hospitalization		6(5-8)
Time to feeding		2(1-3)
ICU stay		1(1-1)
KATZ score patient's activity of daily living		5(4-6)
Lawton – Brody Instrumental Activities of Daily Living Scale		5(4-7)
Mortality	Alive	59(90.8)
	Ex	6(9.2)
	Open	48(73.8)
Operation	Laparoscopy	15(23.1)
	Open after Laparoscopy	2(3.1)
	No	53(81.5)
Post-op delirium	Yes	12(18.5)
	No	46(70.8)
Local complication	Yes	19(29.2)
	No	23(35.4)
Comorbidities	Yes	42(64.6)
	No	47(72.3)
Ileostomy or Colostomy	Yes	18(27.7)
	No	

Results were presented as Mean±SD or Median (IQR:Q1-Q3) for continuous variables and count (n) and percentage (%) for categorical variables

**Table 2**

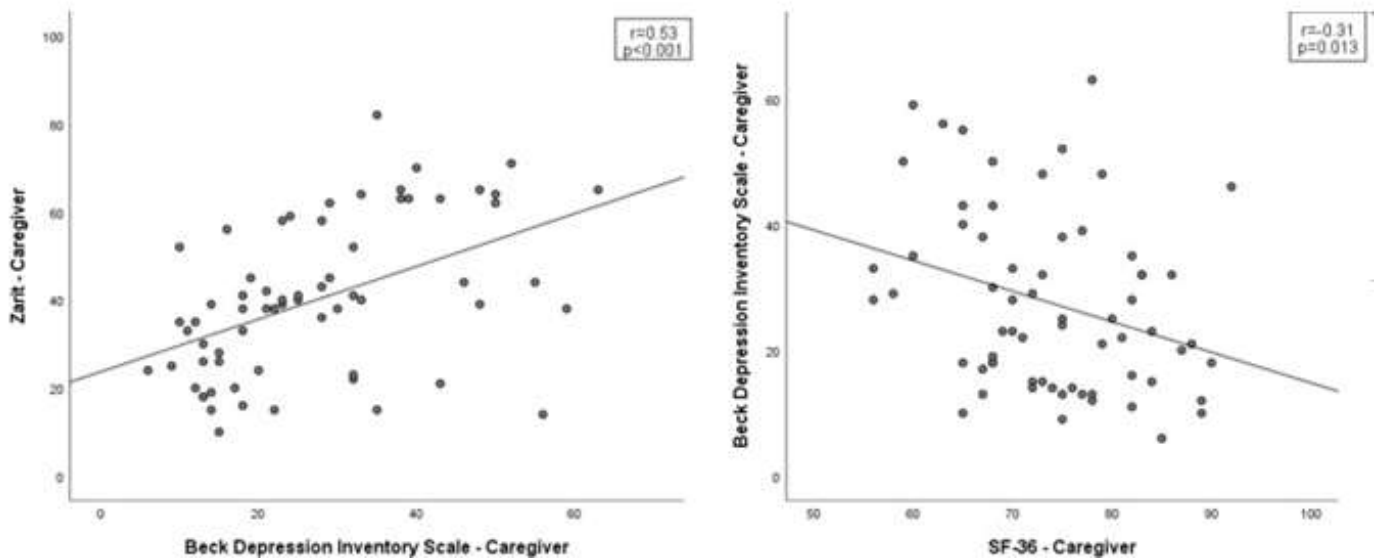
Relationship between patient's and Caregiver's scores

		(1)	(2)	(3)	(4)	(5)	(6)
KATZ score patient's activity of daily living (1)	r	1	0.56	-0.48	-0.43	-0.65	0.19
	p	-	<0.001	<0.001	<0.001	<0.001	0.134
Lawton – Brody Instrumental Activities of Daily Living Scale (2)	r	0.56	1	-0.64	-0.13	-0.71	0.04
	p	<0.001	-	<0.001	0.299	<0.001	0.725
Beck Depression Inventory Scale- Caregiver (3)	r	-0.48	-0.64	1	0.21	0.53	-0.31
	p	<0.001	<0.001	-	0.091	<0.001	0.013
Impact of Event Scale-Revised- Caregiver (4)	r	-0.43	-0.13	0.21	1	0.32	-0.21
	p	<0.001	0.299	0.091	-	0.010	0.100
Zarit - Caregiver (5)	r	-0.65	-0.71	0.53	0.32	1	-0.15
	p	<0.001	<0.001	<0.001	0.010	-	0.236
SF-36 - Caregiver (6)	r	0.19	0.04	-0.31	-0.21	-0.15	1
	p	0.134	0.725	0.013	0.100	0.236	-

r: correlation coefficient. (1) and (2) are scale scores from patients and the others are scale scores from caregivers. The numbers written in parentheses in columns are the same variables as the number written in parentheses next to it in rows.

**Figure 1**

Correlation analysis of (on the left) the caregiving burden and depression level, (on the right) the caregiver's quality of life and depression level.



**Table 3****Factors affecting caregiver depression**

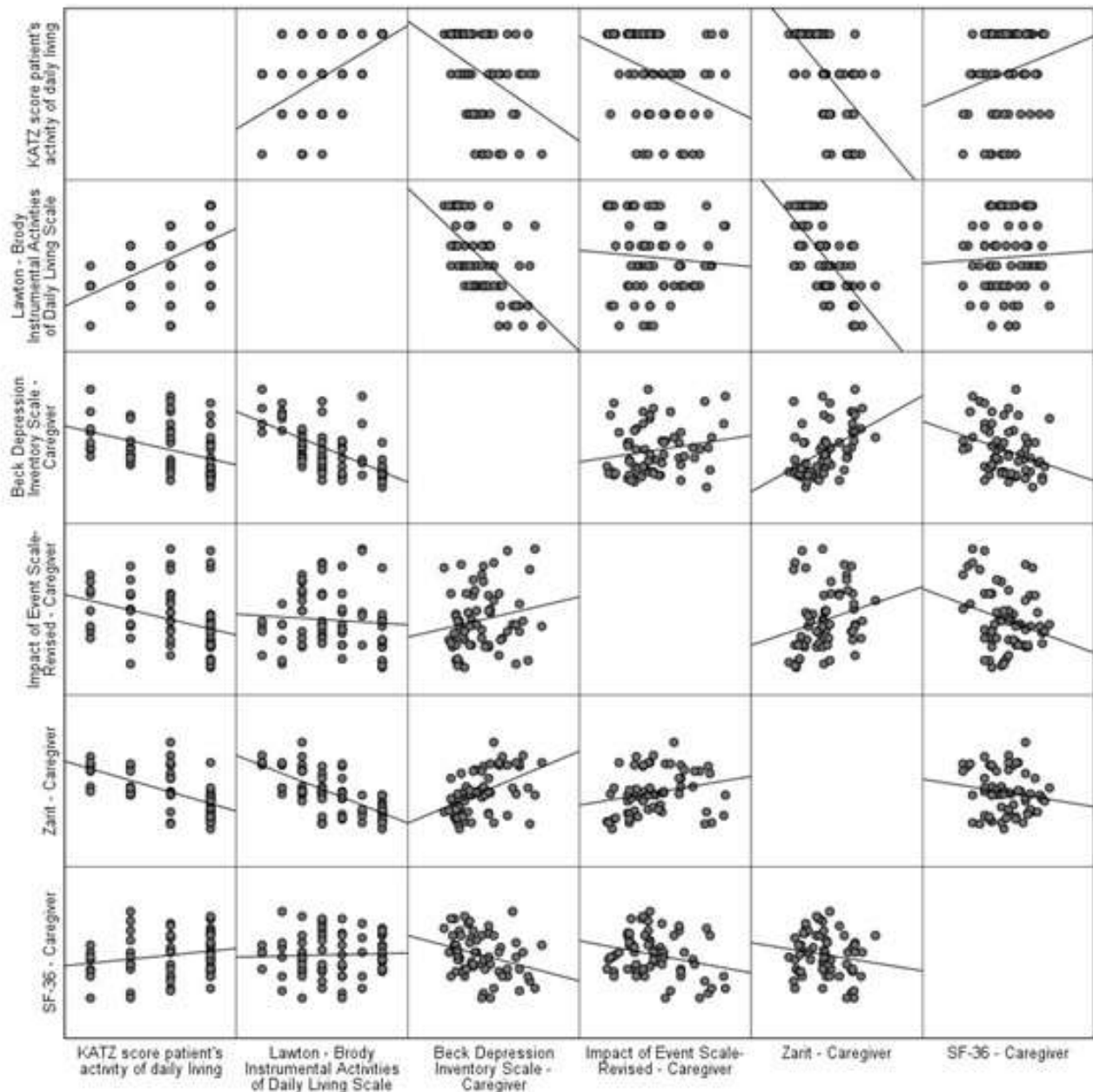
		No depression or Mild depression (n=18)	Moderate or Severe depression (n=47)	p
Caregiver's Age		58.2±15.9	59.2±13.1	0.806
Age		70.6±5.2	70.4±6.1	0.905
Duration of hospitalization		5.5(5-8)	6(5-8)	0.635
Time to feeding		2(1-3)	2(1-3)	0.826
ICU stay		1(1-1)	1(1-1)	0.822
KATZ score patient's activity of daily living		6(6-6)	5(4-6)	<0.001
Lawton – Brody Instrumental Activities of Daily Living Scale		8(6-8)	5(4-6)	<0.001
Impact of Event Scale-Revised – Caregiver		29(23-41)	36(28-53)	0.103
Zarit – Caregiver		26(19-35)	41(38-62)	<0.001
SF-36 – Caregiver		77.4±6.8	72.6±9.2	0.051
Caregiver's Gender	Male	7(38.9)	15(31.9)	0.595
	Female	11(61.1)	32(68.1)	
Caregiver's Marital Status	Married	16(88.9)	36(76.6)	0.538
	Single	1(5.6)	6(12.8)	
	Divorced	1(5.6)	5(10.6)	
	Illiterate	3(16.7)	5(10.6)	
Caregiver's education level	Literate	2(11.1)	7(14.9)	0.684
	Primary School	7(38.9)	12(25.5)	
	Middle School	2(11.1)	10(21.3)	
	High School	3(16.7)	6(12.8)	
	University	1(5.6)	7(14.9)	
Who's the caregiver?	Partner	16(88.9)	27(57.4)	0.023
	Parent (mother/father)	1(5.6)	19(40.4)	
	Child (daughter/son)	1(5.6)	1(2.1)	
Mortality	Alive	18(100)	41(87.2)	0.175
	Ex	0(0)	6(12.8)	
	Open	14(77.8)	34(72.3)	
Operation	Laparoscopy	2(11.1)	13(27.7)	0.042
	Open after Laparoscopy	2(11.1)	0(0)	
Post-op Delirium	No	14(77.8)	39(83)	0.724
	Yes	4(22.2)	8(17)	
Local complication	No	13(72.2)	33(70.2)	0.873
	Yes	5(27.8)	14(29.8)	
Comorbidities	No	2(11.1)	21(44.7)	0.011
	Yes	16(88.9)	26(55.3)	
Ileostomy or Colostomy	No	16(88.9)	31(66)	0.119
	Yes	2(11.1)	16(34)	

Results were presented as Mean±SD or Median (IQR:Q1-Q3) for continuous variables and count (n) and percentage (%) for categorical variables



Figure 2

Correlation analysis of all scores



These findings are similar to other studies in the literature that have reported that caregivers are predominantly middle-aged women, a trend commonly attributed to sociocultural factors.<sup>18,19</sup>

A key finding of our investigation is the strong negative correlation between patient functional status and both caregiver burden and depression. The literature consistently reports declines in patients' independence and difficulties with activities of daily living following such procedures, often necessitating support from family members or hired caregivers.<sup>20,21</sup> In our study, patients' activities of daily living were assessed using the Katz Index and the Lawton-Brody scale, yielding median scores of 5 (IQR: 4–6) and 5 (IQR: 4–7), respectively. These findings indicate that while most patients maintained moderate independence in basic self-care tasks, some required partial assistance. This functional dependency may heighten caregiver burden and precipitate psychological distress.

Furthermore, research has demonstrated that losses in functional independence after surgery can adversely affect patients' social interactions, psychological well-being, and overall quality of life.<sup>21,22</sup> Such declines in function place both physical and emotional strain on caregivers, potentially triggering issues such as caregiver depression.

Our findings on caregiver stress and depression levels are consistent with a growing body of literature. For example, a study of transplant patients found that 22% to 60.3% of caregivers reported psychological distress.<sup>23</sup> Similarly, a study on caregivers of coronary artery bypass surgery patients found a significant association between caregiver burden and depressive symptoms.<sup>24</sup> Consistent with these findings, our study identified a significant, moderate positive correlation between caregiver burden and depression: as burden increased, so did depressive symptoms ( $r = 0.53$ ,  $p < 0.001$ ). We

also observed a weak negative correlation between caregivers' quality of life and their depression levels ( $r = -0.31$ ,  $p = 0.013$ ), suggesting that higher depression levels are associated with lower quality of life, a finding that should be explored further in future research. Additionally, a moderate positive correlation was noted between scores on the Impact of Event Scale and the Zarit Caregiver Burden Scale, suggesting that caregivers' exposure to stressful or traumatic events may amplify their perceived burden.

Caregivers experiencing depression often face challenges in their daily functioning and exhibit poorer physical health.<sup>26,26</sup> Research has also shown that caregiver depression and burden are linked to the patient's functional status.<sup>26,27</sup> In our study, we found that caregivers with moderate to severe depression had patients with significantly lower Katz Index scores compared to caregivers with no or mild depression. A similar pattern was observed for the Lawton–Brody Instrumental Activities of Daily Living Scale. Zarit Caregiver Burden Scale scores were significantly higher among caregivers with high depression levels, and the presence of comorbidities was more common among patients cared for by highly depressed caregivers. These findings indicate that caregiver depression not only adversely affects the caregiver's own burden and quality of life but also has a significant impact on patients' daily functioning and overall health status.

Our findings can be considered alongside prior work on caregiver outcomes after surgery in older adults. Bryson et al. examined caregiver experiences following ambulatory surgery and found stress largely related to pain, mobility, and discharge information during the first postoperative week. By contrast, our study of major abdominal cancer surgery demonstrated a stronger link between caregiver depression, burden, and poor functional recovery, reflecting the heavier challenges of more invasive procedures. Similarly, Janssen et al. studied 248 caregivers of patients undergoing elective colorectal or aneurysm surgery and reported that caregiver strain peaked shortly after discharge but declined below baseline within 12 months.<sup>29</sup> Our prospective design instead captured the early postoperative period, showing that this is when both caregiver and patient outcomes are most vulnerable. Finally, Navab et al. synthesized 13 caregiver intervention studies in a systematic review, finding that only nurse-led education and follow-up showed modest benefits.<sup>30</sup> While we did not test an intervention, our results highlight the urgent need for targeted strategies that address caregiver psychological distress as a pathway to improving both caregiver well-being and patient recovery. A primary limitation of this study is its single-center design, which restricted the sample size. This small sample size precluded the use of advanced statistical methods, such as regression analyses, to further explore the complex interrelationships between the variables. Additionally, the reliance on self-identified caregivers introduces potential selection bias, as those who volunteer may differ systematically from those who do not. The use of self-reported scales also carries the risk of social desirability bias, where participants might underreport negative emotions such as depression or burden. A further limitation is that patient comorbidities were not assessed using a validated index such as the Charlson Comorbidity Index (CCI); instead, comorbidities were documented only in aggregate form. Another important limitation is that patient functional status was assessed only once in the immediate postoperative period. Serial measurements both preoperatively and at multiple postoperative time points would have enabled a more comprehensive evaluation of functional decline and its temporal relationship with caregiver burden. In addition, we used only the total Katz Index score without analyzing subdomains such as mobility or continence, and we did not collect data on clinical measures such as pressure ulcers. These factors may differentially affect caregiver burden, and future studies should assess them to provide a more

complete understanding of patient–caregiver outcomes. Another limitation is that pre-hospitalization ADL scores were not collected, which prevents direct comparison of functional decline and recovery. Despite these limitations, the study's novel focus and significant contributions emphasize the need for further research with larger, multi-center cohorts. Such studies would allow for more reliable statistical analyses and a better understanding of the factors that influence caregiver and patient outcomes.

## 5. Conclusion

In conclusion, our study demonstrates a significant positive correlation between caregiving burden and depression in caregivers of older patients following major abdominal surgery. Importantly, higher levels of caregiver depression were associated with worse patient functional outcomes. These findings highlight the urgent need for routine screening and psychological support programs for this vulnerable population to improve both caregiver well-being and patient recovery.

## Statement of ethics

This prospective study was approved by the Adana City Training and Research Hospital Clinical Research Ethics Committee, (The project number is 3179, approval date:15.02.2024). authors declare that the study was conducted in accordance with the Declaration of Helsinki and followed the ethical standards of Turkey.

## genAI

No artificial intelligence-based tools or generative AI technologies were used in this study. The entire content of the manuscript was originally prepared, reviewed, and approved by both authors.

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## Conflict of interest statement

The authors declare that they have no conflict of interest.

## Availability of data and materials

The available data are maintained by Adana City Training and Research Hospital and are securely stored within the institution. These data cannot be shared without prior authorization. Researchers who meet the criteria for accessing confidential data are encouraged to contact the Ethics Committee of Adana City Hospital for further assistance. Data Access/Ethics Committee: [Adanasehir.etikkurul@saglik.gov.tr](mailto:Adanasehir.etikkurul@saglik.gov.tr)

## Author contributions

Both authors contributed equally to the article. Both authors read and approved the final manuscript.

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