

## Original Article

Cognitive Impairment in Caregivers of Cancer Patients:  
A Cross-sectional Study

Elif Şenocak Taşçı<sup>1</sup>, Aziz Yazar<sup>2</sup>, Ömer Orhun<sup>3</sup>, Müjdat Kara<sup>4</sup>, Başak Oyan<sup>5</sup>, Gül Başaran<sup>5</sup>, Özlem Sönmez<sup>5</sup>,  
Eda Seçim<sup>2</sup>, Sabiha Yüce Hatipoğlu<sup>2</sup>

<sup>1</sup>University of Health Sciences Turkey, Kanuni Sultan Süleyman Training and Research Hospital, Clinic of Medical Oncology, İstanbul, Turkey

<sup>2</sup>Acıbadem Altunizade Hospital, Clinic of Medical Oncology, İstanbul, Turkey

<sup>3</sup>İstanbul University Cerrahpaşa-Cerrahpaşa Faculty of Medicine, Department of Neurosurgery, İstanbul, Turkey

<sup>4</sup>Acıbadem Mehmet Ali Aydınlar University Faculty of Medicine, Department of Endocrinology, İstanbul, Turkey

<sup>5</sup>Acıbadem Mehmet Ali Aydınlar University Faculty of Medicine, Department of Medical Oncology, İstanbul, Turkey

## ABSTRACT

**Aim:** Cancer caregivers (CCG) is crucial in well-being of patients with cancer. They are responsible for making cognitively demanding decisions that affect patients' welfare. In this study, we aimed to evaluate the cognitive impairment of CCG and compare with non-CCG.

**Methods:** This cross-sectional study focused on CCG and non-CCG patients at a university hospital. Caregiver-reported outcomes were measured by mini-mental state examination (MMSE).

**Results:** A total of 217 caregivers were included. 122 (56.3%) were in the CCG group and 95 (43.7%) were in the non-CCG group. The median age of the caregivers was 46.6 (20-76) years, and 56.6% were female. Education level was significantly higher among CCG (64.7 vs 29.5%,  $p<0.001$ ). Mean MMSE scores were 27.9 and 24.2 for the non-CCG and CCG groups, respectively, corresponding to 0% and 40.1% of caregivers in the non-CCG and CCG groups with cognitive impairment. The mean difference in MMSE scores was statistically significant in all areas of cognitive function ( $p<0.001$ ). In the CCG group with cognitive impairment, 15 and 40 patients had mild and moderate cognitive impairment. Cognitive impairment based on the MMSE was significantly associated with old age ( $p=0.006$ ) and lower education level ( $p=0.001$ ).

**Conclusion:** This study revealed that cognitive impairment in CCGs is not uncommon. Because caregivers are decision makers during most of the disease processes of patients with cancer, any deterioration in their cognitive reserve should be checked to maintain optimal care for patients.

**Keywords:** Caregiver, cancer, cognitive impairment, mini-mental state examination

## Introduction

The survival rate of cancer is increasing daily with the introduction of new treatment modalities. Patients live longer due to the psychological, social, and physical burden of the disease and treatment. Informal caregivers are non-professional, unpaid caregivers of patients who share this burden. They are usually individuals from the family setting or friends who take on different roles secondary to physical or cognitive impairment of the patient [1]. According to a caregiving report in the United States published in May 2020, cancer is the 2<sup>nd</sup> common illness for which a caregiver is needed [2].

Informal caregivers of patients with chronic diseases take on many responsibilities, such as cooking, traveling, scheduling, hospital policies, and economic difficulties, and, most importantly, deciding between treatment options. It has been found that cancer caregivers (CCG) are more likely to co-reside with patients and provide care for approximately 33 hours weekly and help in different types of activities of daily living (getting in and out of a bed, chair, or toilet and feeding) [3,4]. Thus, it is important to evaluate informal caregivers' cognitive abilities to determine whether they are capable of making decisions on behalf of patients with cancer [5]. Their health can be affected in the long term because of increasing stress, causing changes in neurohormonal and inflammatory

**Cite this article as:** Şenocak Taşçı E, Yazar A, Orhun Ö, Kara M, Oyan B, Başaran G, Sönmez Ö, Seçim E, Yüce Hatipoğlu S. Cognitive Impairment in Caregivers of Cancer Patients: A Cross-sectional Study. Acta Haematol Oncol Turc. 2024;57(2):51-55

**Address for Correspondence:** Elif Şenocak Taşçı MD, University of Health Sciences Turkey, Kanuni Sultan Süleyman Training and Research Hospital, Clinic of Medical Oncology, İstanbul, Turkey

**Phone:** +90 536 861 98 17 **E-mail:** esenocak@gmail.com **ORCID ID:** orcid.org/0000-0002-1686-1628

**Received:** 15.01.2024 **Accepted:** 09.05.2024 **Available Online Date:** 27.08.2024



©Copyright 2024 The Author. Published by Galenos Publishing House on behalf of Ankara Hematology Oncology Association. Licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND) International License



processes [6]. When caregivers' quality of life deteriorates, especially their mental health, optimal support and long-term care may be compromised. This may even affect patient treatment. Since the course of a disease differs among cancer patients and clinical deterioration can progress more rapidly, caregiving may differ from other chronic diseases [7].

The mini-mental state examination (MMSE) is one of the most widely used screening tests for identifying cognitive impairment. It was first developed by Folstein et al. [8] in 1975 and has since been widely used in research and clinical settings. Although designed for identifying cognitive impairment, it is mostly used in clinical practice to identify dementia and Alzheimer disease. To our knowledge, no previous studies have evaluated the cognitive status of caregivers using the MMSE.

Herein, we aimed to evaluate the cognitive impairment of cancer caregivers and compare it with that of caregivers of patients with a chronic disease other than cancer (non-CCG) using the MMSE.

## Methods

### Study Design

This prospective cross-sectional study was conducted at a university hospital. The Acibadem University Local Ethics Committee approved the study protocol on 17.09.2020 (approval number: ATADEK-2020-20/5, date: 17.09.2020). Caregivers and patients were informed about the study. After receiving informed consent from the volunteering caregivers, questionnaires were conducted face-to-face by clinical nurses under supervision of a doctor in the hospital's daily chemotherapy and endocrinology clinic.

### Participants

The eligibility criteria for cancer caregivers were as follows; aged <18 years; caring for a patient with cancer under treatment; not having any hearing abnormalities, any known psychological or central nervous system disorder, or any history of cancer; and not undergoing active treatment that could influence cognitive abilities. The control group, caregivers of patients receiving treatment for a chronic endocrinological disorder were included. Information about the caregivers was obtained from the caregivers themselves. The demographic and clinical characteristics of the patients and their treatment schedules were obtained from their medical records.

In the cancer group, targeted treatments received by patients were defined as anti-vascular endothelial growth factor therapy, anti-endothelial growth factor therapy, and anti-HER2 therapy. Hormone treatment was defined as antiandrogen and antiestrogen therapy. The endocrinological group comprised patients with hypothyroidism, diabetes mellitus, adrenal insufficiency, and Cushing's syndrome.

### Assessments and Tools

Cognitive performance was assessed using the MMSE. A validated Turkish version of the MMSE was used [9]. The MMSE

comprises 11 questions. It measures registration, attention, calculation, recall, language, and orientation functions. Administration of the test takes 5-10 minutes. Cognitive impairment was defined as an MMSE score <24. Severe, moderate, and mild cognitive impairment were defined as MMSE scores under 9, 10-18, and 19-23, respectively.

### Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences version 25.0 (IBM, Armonk, New York, USA). Continuous variables were compared using the independent samples t-test and Mann-Whitney U test. Binary logistic regression analysis was performed to determine the odds ratio for predictive factors. Pearson's correlation test was used to evaluate correlations between continuous variables. P value of <0.05 was accepted as indicative of statistical significance.

## Results

A total of 217 caregivers were included in the study. Of these, 122 (56.3%) were classified into the CCG group, and 95 (43.7%) were classified into the non-CCG group. The median age of the caregivers was 46.6 (20-76) years, and 56.6% were female. The detailed demographic and clinical characteristics of the caregivers are presented in Table 1. Education level was significantly higher among CCG (64.7 vs 29.5%,  $p<0.001$ ). A total of 64.7% of patients in the CCG group and 29.5% of patients in the non-CCG group had a university degree or higher. Most of the relatives of patients with cancer were spouses (35.2%) or children (29.5%), whereas in the non-CCG group, the majority were spouses (45.3%) and parents (24.2%) ( $p<0.001$ ). Patients were mainly diagnosed with breast cancer ( $n=39$ , 31.9%), gastrointestinal cancer ( $n=28$ , 22.9%), and lung cancer ( $n=23$ , 18.8%). The time since diagnosis was less than a year for most of the patients ( $n=59$ , 48.3%), and most patients had stage 4 disease ( $n=78$ , 63.9%). The Eastern Cooperative Oncology Performance Status of patients were 0-1 for 76% of the patients. The demographic and clinical characteristics of patients with cancer are presented in Table 2.

The mean MMSE scores were 27.9 and 24.2 in the non-CCG and CCG groups, respectively. Cognitive impairment was not observed in the non-CCG group, whereas 40% of the CCG group exhibited cognitive impairment. The mean difference in MMSE scores was statistically significant in all areas of cognitive function ( $p<0.001$ , Table 3). Figure 1 shows boxplots of scores according to MMSE components. Language subscale scores were significantly different between the two groups.

Regarding the CCG group with cognitive impairment, 40 patients had mild impairment (MCI) while 15 had moderate cognitive impairment. According to the univariate analysis, cognitive impairment based on the CCG on the MMSE was statistically associated with old age ( $p=0.006$ ) and lower education level ( $p=0.001$ , Table 4). Multivariate analysis was performed to identify independent predictors of cognitive impairment. Education level ( $p=0.009$ ) was found to be the only predictor of cognitive impairment.

**Table 1. Demographic and clinical characteristics of caregivers**

|                                      | Non-CCG (n=95) | CCG (n=122)  | p       |
|--------------------------------------|----------------|--------------|---------|
| Age (min.-max.)                      | 47.2 (20-76)   | 46.2 (20-72) | 0.724   |
| <b>Sex</b>                           |                |              |         |
| Female                               | 48 (50.5%)     | 75 (61.5%)   | 0.106   |
| Male                                 | 47 (49.5%)     | 47 (38.5%)   |         |
| <b>Social status</b>                 |                |              |         |
| Single/divorced                      | 18 (19%)       | 32 (26.2%)   | 0.448   |
| Married                              | 77 (81.1%)     | 90 (73.8%)   |         |
| <b>Level of education</b>            |                |              |         |
| Uneducated                           | 1 (1.1%)       | 3 (2.5%)     | <0.001* |
| Primary school                       | 29 (30.5%)     | 7 (5.7%)     |         |
| Secondary school                     | 8 (8.4%)       | 9 (7.4%)     |         |
| High school                          | 29 (30.5%)     | 24 (19.7%)   |         |
| University                           | 25 (26.3%)     | 63 (51.6%)   |         |
| Postgraduate                         | 3 (3.2%)       | 16 (13.1%)   |         |
| <b>Occupation</b>                    |                |              |         |
| Employed/student                     | 36 (37.9%)     | 50 (41%)     | 0.644   |
| Unemployed/retired                   | 59 (62.1%)     | 72 (59%)     |         |
| <b>Chronic disease</b>               |                |              |         |
| Present                              | 26 (27.4%)     | 22 (18%)     | 0.100   |
| Absent                               | 64 (72.6%)     | 100 (82%)    |         |
| <b>Relationship with the patient</b> |                |              |         |
| Parents                              | 23 (24.2%)     | 7 (5.7%)     | <0.001* |
| Siblings                             | 5 (5.3%)       | 14 (11.5%)   |         |
| Children                             | 14 (14.7%)     | 36 (29.5%)   |         |
| Partners                             | 43 (45.3%)     | 43 (35.2%)   |         |
| Others                               | 10 (10.5%)     | 22 (18.0%)   |         |

\*p value <0.05.  
CCG: Cancer caregivers, Min.-max.: Minimum-maximum

The variables were further analyzed using binomial logistic regression models to understand their predictive value for MCI among cancer caregivers. Patients with a university degree or higher education were 59% less likely to have cognitive impairment. Caregivers that were children were 92% less likely to suffer from cognitive impairment. Chemotherapy was associated with a 71% decreased risk of MCI among the different treatment modalities.

## Discussion

In this study, we aimed to assess cognitive impairment among cancer caregivers. The MMSE was used to evaluate cognitive impairment, which, to our knowledge, is the first study to use the mini-mental test as a screening tool among caregivers. The MMSE scores of cancer caregivers were lower than those of non-cancer caregivers in all aspects, indicating higher cognitive impairment among CCGs. Most patients in the CCG group suffered from mild cognitive impairment, with scores between 19 and 24. Language was the most impaired area in the MMSE scores of CCGs. Education and age were found to be predictors of cognitive impairment.

The MMSE is a commonly preferred test to screen cognitive mental status in the elderly population, with an estimated

**Table 2. Demographic and clinical characteristics of patients with cancer**

|                               | n (%)      |
|-------------------------------|------------|
| Age (years)                   | 56 (28-80) |
| <b>Sex</b>                    |            |
| Female                        | 75 (61.4)  |
| Male                          | 47 (38.5)  |
| <b>Time since diagnosis</b>   |            |
| ≤12 months                    | 59 (48.3)  |
| 12-24 months                  | 21 (17.2)  |
| ≥24 months                    | 42 (34.4)  |
| <b>ECOG</b>                   |            |
| 0                             | 46 (37.7)  |
| 1                             | 46 (37.7)  |
| 2                             | 27 (22.1)  |
| 3                             | 3 (2.4)    |
| <b>Stage</b>                  |            |
| 1                             | 14 (11.4)  |
| 2                             | 16 (13.1)  |
| 3                             | 14 (11.4)  |
| 4                             | 78 (63.9)  |
| <b>Treatment type</b>         |            |
| Chemotherapy                  | 72 (59)    |
| Chemotherapy+targeted therapy | 18 (14.7)  |
| Immunotherapy                 | 6 (4.9)    |
| Hormone treatment             | 13 (10.6)  |
| Targeted therapy              | 13 (10.6)  |

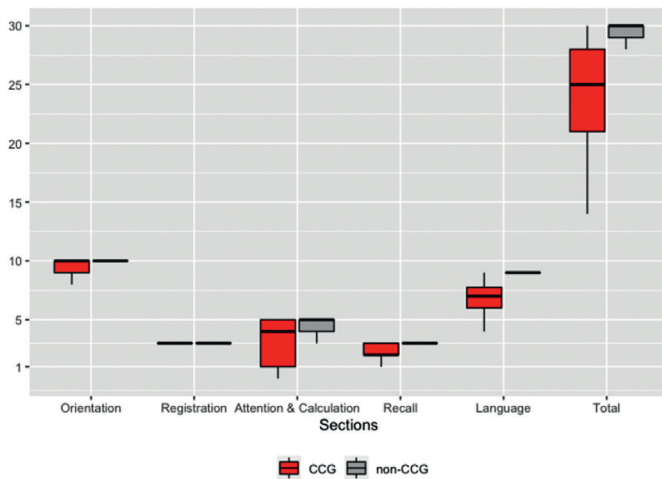
ECOG: Eastern Cooperative Oncology Group, Min.-max.: Minimum-maximum

**Table 3. MMSE scores of caregivers**

|                           | Non-CCG (n=95) | CCG (n=122) | p       |
|---------------------------|----------------|-------------|---------|
| Orientation               | 9.99±0.103     | 9.24±1.068  | <0.001* |
| Registration              | 3.04±0.459     | 2.67±0.787  | <0.001* |
| Attention and calculation | 4.68±0.593     | 3.20±1.872  | <0.001* |
| Recall                    | 2.83±0.519     | 2.22±0.838  | <0.001* |
| Language                  | 8.96±0.202     | 6.84±1.410  | <0.001* |
| Total                     | 29.40±1.086    | 24.17±4.111 | <0.001* |
| CI (total score <24)      | 0 (0%)         | 49 (40.1%)  | <0.001* |

\*p value <0.05.  
CI: Cognitive impairment, MMSE: Mini-mental state examination, CCG: Cancer caregivers

sensitivity and specificity of 85-92% and 85-93%, respectively [10]. Although it cannot be used for making formal diagnoses, it is used as the first step in detecting cognitive impairment [11]. Cognitive impairment is defined as trouble concentrating, learning new things, and making everyday life decisions. Although impairment has been proven in caregivers of patients with dementia or stroke, cognitive dysfunction in CCGs is a less frequently examined field [12,13]. In our study, MCI seen in 40% of CCGs is noteworthy. The statistically significant difference in MMSE scores between the two caregiver groups also demonstrates the high disease burden on CCGs. Unlike non-CCGs, CCGs spend approximately 35



**Figure 1.** Boxplots of MMSE scores in the CCG and non-CCG groups  
MMSE: Mini-mental state examination, CCG: Cancer caregivers

**Table 4. Predictive factors of cognitive impairment in the CCG group**

|  | Score ≤24<br>(n=55) | Score >24<br>(n=67) | P            |
|--|---------------------|---------------------|--------------|
| Age (years)**                            | 49.7±11.5           | 43.4±12.8           | <b>0.006</b> |
| Sex (male)**                             | 18 (32.7%)          | 29 (43.3%)          | 0.233        |
| Marital status**                         | 43 (78.2%)          | 47 (70.1%)          | 0.136        |
| Education level of university students** | 27 (49.1%)          | 52 (77.6%)          | <b>0.001</b> |
| Comorbidities**                          | 14 (25.5%)          | 8 (11.9%)           | 0.053        |
| Relatedness (first degree)**             | 13 (23.6%)          | 30 (44.8%)          | <b>0.015</b> |
| Sex (male)***                            | 21 (38.2%)          | 25 (37.3%)          | 0.922        |
| Age (years) ***                          | 54 (23%)            | 57 (21%)            | 0.265        |
| Stage 4 disease                          | 35 (66.1%)          | 43 (64.2%)          | 0.832        |
| ECOG***                                  | 22 (40%)            | 24 (35%)            | 0.459        |
| Mean time after diagnosis*** (month)     | 14 (29%)            | 12 (34%)            | 0.451        |
| Polypharmacy***                          | 6 (10.9%)           | 14 (20.9%)          | 0.138        |

\*p<0.05.  
ECOG: Eastern Cooperative Oncology Group\*\*, Characteristics of caregivers\*\*\* Characteristics of patients, CCG: Cancer caregivers

hours a week on the patient's daily activities [14]. This may cause them to withdraw from social life, have a negative impact on relationships, experience loss of communication, and thus weaken their cognitive functions. Therefore, the mild and moderate cognitive impairment observed among cancer caregivers may be the result of caregiver burden, leading to decreased quality of life and interference with the capacity of caregivers to provide optimal care [15]. High cortisol levels and stress, which are used to explain cognitive dysfunction in patients with dementia, may also affect CCG levels [16].

The effect of MMSE scores on dementia prediction is well known. However, cognitive dysfunction, apart from dementia, may be a primary indicator of functional impairment in major depressive disorder [17]. The global prevalence of depression

among CCGs across studies was 42.08%, and a subgroup analysis showed that the pooled prevalence of depression in studies that used a cross-sectional study design (42%), like our study, was higher than that in studies with a longitudinal study design (34%) [18]. Sleep disturbances and fatigue may also affect cognitive impairment, which can be observed in CCGs. However, when the secondary causes of cognitive dysfunction are excluded, cognitive dysfunction becomes a core component of depressive disorder. Thus, learning, memory, executive functioning, processing, and attention/concentration may be significantly impaired [19]. Antidepressants and/or pharmacotherapy can improve residual cognitive function [20]. Thus, caregivers diagnosed with cognitive impairment may be referred for treatment.

Education level and age were found to be predictors of cognitive impairment. Studies have shown that mild cognitive impairment affects quality of life [21]. In a study by Decadt et al. [22], caregiver age and education level were not associated with decreased quality of life or increased stress. However, the relationship between patient and patient's diagnosis were significantly related to distress levels. In contrast, Kilic and Oz [23] found that gender, education level, and relationship to the patient were significantly associated with quality of life. Education level and employment status are closely related to an individual's ability to communicate and cope with stress. Unemployed caregivers spend more time with patients, affecting their cognitive status and mood and increasing their susceptibility to depression. Finding age as a predictor of cognitive impairment was expected because cognitive changes occur even with normal aging. This also explains the decreased risk of impairment observed when the caregiver is the child of the patient.

### Study Limitations

The study has several limitations. The MMSE scores were not interpreted in consideration of age and education norms. The MMSE also has several disadvantages, such as a lack of exploration of all cognitive domains. The possible reasons for the low MMSE scores in the CCG group, such as depression, sleep problems, and dementia, were not examined. Owing to the cross-sectional study design, potential changes over time may be confounding factors of lower MMSE scores among CCGs. Longitudinal studies are needed to understand how caregiver outcomes evolve. Third, the disease burden of the control group may be lower than that of patients with cancer, which may interfere with the reliability of the comparison. Lastly, the sample size is small, which may explain the lack of influence of patient factors on cognitive impairment among caregivers.

Our results are worth attention for healthcare professionals to better address cancer caregivers that are in need of support during patient's active treatment. The MMSE, which is an easily applicable test, can be incorporated into caregiver distress screening methods because cognitive impairment can be a sign of depression.

## Conclusion

Most patients with cancer seek physical or psychological support, which is generally provided by their informal caregivers. Thus, the cognitive functioning of CCGs is significant because they make many decisions on behalf of the patient. Our study, which is the first to use MMSE in caregivers, emphasizes that cognitive assessment among caregivers is worth noting because cognitive impairment in CCGs is not an uncommon symptom and may interfere with the well-being of patients. Interventions should be developed to reduce the psychosocial and psychological burden of caregiving that causes cognitive decline in CCG patients.

## Ethics

**Ethics Committee Approval:** The Acıbadem University Local Ethics Committee approved the study protocol on 17.09.2020 (approval number: ATADEK-2020-20/5, date: 17.09.2020).

**Informed Consent:** Consent form was filled out by all participants.

## Authorship Contributions

Surgical and Medical Practices: A.Y., Ö.O., Concept: A.Y., Design: A.Y., Data Collection or Processing: A.Y., M.K., E.S., B.O., G.B., Ö.S., S.Y.H., Ö.O., Analysis or Interpretation: A.Y., Ö.O., Literature Search: E.Ş.T., Writing: E.Ş.T.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study received no financial support.

## References

1. Aguiló S, García E, Arza A, Garzón-Rey JM, Aguiló J. Evaluation of chronic stress indicators in geriatric and oncologic caregivers: a cross-sectional study. *Stress*. 2018;21:36-42.
2. Bechthold AC, Azuero A, Puga F, Ejem DB, Kent EE, Ornstein KA, et al. What Is Most Important to Family Caregivers When Helping Patients Make Treatment-Related Decisions: Findings from a National Survey. *Cancers (Basel)*. 2023;15:4792.
3. Kim Y, Schulz R. Family caregivers' strains: comparative analysis of cancer caregiving with dementia, diabetes, and frail elderly caregiving. *J Aging Health*. 2008;20:483-503.
4. Washington KT, Pike KC, Demiris G, Oliver DP. Unique characteristics of informal hospice cancer caregiving. *Support Care Cancer*. 2015;23:2121-2128.
5. Wolff JL, Spillman BC, Freedman VA, Kasper JD. A National Profile of Family and Unpaid Caregivers Who Assist Older Adults With Health Care Activities. *JAMA Intern Med*. 2016;176:372-379.
6. Rohleder N, Marin TJ, Ma R, Miller GE. Biologic cost of caring for a cancer patient: dysregulation of pro- and anti-inflammatory signaling pathways. *J Clin Oncol*. 2009;27:2909-2915.
7. Sherwood PR, Given BA, Donovan H, Baum A, Given CW, Bender CM, et al. Guiding research in family care: a new approach to oncology caregiving. *Psychooncology*. 2008;17:986-996.
8. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975;12:189-198.
9. Keskinoglu P, Ucku R, Yener G, Yaka E, Kurt P, Tunca Z. Reliability and validity of revised Turkish version of Mini Mental State Examination (rMMSE-T) in community-dwelling educated and uneducated elderly. *Int J Geriatr Psychiatry*. 2009;24:1242-1250.
10. Shulman KI, Herrmann N, Brodaty H, Chiu H, Lawlor B, Ritchie K, et al. PA survey of brief cognitive screening instruments. *Int Psychogeriatr*. 2006;18:281-294.
11. Tangalos EG, Smith GE, Ivnik RJ, Petersen RC, Kokmen E, Kurland LT, et al. The Mini-Mental State Examination in general medical practice: clinical utility and acceptance. *Mayo Clin Proc*. 1996;71:829-837.
12. de Vugt ME, Jolles J, van Osch L, Stevens F, Aalten P, Lousberg R, et al. Cognitive functioning in spousal caregivers of dementia patients: findings from the prospective MAASBED study. *Age Ageing*. 2006;35:160-166.
13. Chen P, Botticello AL. Spouses of stroke survivors may be at risk for poor cognitive functioning: a cross-sectional population-based study. *Top Stroke Rehabil*. 2013;20:369-378.
14. Sun V, Raz DJ, Kim JY. Caring for the informal cancer caregiver. *Curr Opin Support Palliat Care*. 2019;13:238-242.
15. Thana K, Lehto R, Sikorskii A, Wyatt G. Informal caregiver burden for solid tumour cancer patients: a review and future directions. *Psychol Health*. 2021;36:1514-1535.
16. Vitaliano PP, Murphy M, Young HM, Echeverria D, Borson S. Does caring for a spouse with dementia promote cognitive decline? A hypothesis and proposed mechanisms. *J Am Geriatr Soc*. 2011;59:900-908.
17. McIntyre RS, Cha DS, Soczynska JK, Woldeyohannes HO, Gallagher LA, Kudlow P, et al. Cognitive deficits and functional outcomes in major depressive disorder: determinants, substrates, and treatment interventions. *Depress Anxiety*. 2013;30:515-527.
18. Bedaso A, Dejenu G, Duko B. Depression among caregivers of cancer patients: Updated systematic review and meta-analysis. *Psychooncology*. 2022;31:1809-1820.
19. Pan Z, Park C, Brietzke E, Zuckerman H, Rong C, Mansur RB, et al. Cognitive impairment in major depressive disorder. *CNS Spectr*. 2019;24:22-29.
20. Lam RW, Kennedy SH, McIntyre RS, Khullar A. Cognitive dysfunction in major depressive disorder: effects on psychosocial functioning and implications for treatment. *Can J Psychiatry*. 2014;59:649-654.
21. Hussenöder FS, Conrad I, Roehr S, Fuchs A, Pentzek M, Bickel H, et al. Mild cognitive impairment and quality of life in the oldest old: a closer look. *Qual Life Res*. 2020;29:1675-1683.
22. Decadt I, Laenen A, Celus J, Geyskens S, Vansteenlandt H, Coolbrandt A. Caregiver distress and quality of life in primary caregivers of oncology patients in active treatment and follow-up. *Eur J Cancer Care (Engl)*. 2021;30:e13399.
23. Kilic ST, Oz F. Family Caregivers' Involvement in Caring with Cancer and their Quality of Life. *Asian Pac J Cancer Prev*. 2019;20:1735-1741.