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Factors Associated With the Variability in Caregiver Assessments of the Capacities of Patients With Alzheimer Disease

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Abstract

Background: Several studies have identified certain caregiver factors that can produce variability in their assessments of the capacities of patients with Alzheimer disease (AD). **Objectives:** To identify the caregiver variables associated with variability in their ratings of patients' capacities. **Methods:** Consecutive sample of 221 outpatients with AD and their family caregivers. The capacities evaluated by caregivers were the degree of functional disability, using the Disability Assessment for Dementia (DAD); psychological and behavioral symptoms, via the Neuropsychiatric Inventory (NPI); anosognosia, with the Anosognosia Questionnaire-Dementia (AQ-D); and quality of life, using the Quality of Life in AD (QOL-AD). The relationship between these measures and caregiver's gender, burden, depression, and health was analyzed by means of a bivariate analysis, calculating the effect size (Cohen *d*) and subsequently by a regression analysis, calculating the contribution coefficient (CC). **Results:** The greatest variability in caregiver assessments was observed in relation to patients with early-stage dementia, where caregiver's burden was the main factor associated with a more negative evaluation ($d = 1.02$ - 1.25). Depression in the caregiver was associated with less variability and only in the assessments of patients with moderate dementia ($d = 0.38$ - 0.69). In the regression analysis, caregiver factors were associated with greater variance in scores on the NPI (CC = 37.4%) and QOL-AD (CC = 27.2%), and lower variance in AQ-D (CC = 21.6%) and DAD (CC = 10.3%) scores. **Conclusions:** Caregiver's burden and depression were associated with more negative assessments of patients' psychological and behavioral symptoms and quality of life.

Keywords

Alzheimer disease, family caregivers, functional capacity, neuropsychiatric symptoms, anosognosia, quality of life

Introduction

In clinical practice and research, certain characteristics of the patient with Alzheimer disease (AD), such as functional status, the presence of behavioral and psychological symptoms of dementia (BPSD), anosognosia, and quality of life, are assessed using measures that rely on the information obtained from caregivers. This information serves as a complement to professional reports and may be used to assess the suitability and effectiveness of therapeutic interventions. However, various studies have identified certain caregiver factors that can produce variability (and lead to errors or bias) in their assessment of the patient's capacities.

With respect to functional status, biased assessments have been associated with depression in the caregiver¹ as well as with greater burden,^{2,3} both of which lead to underestimation of the patient's capacities. Similarly, caregiver reports of patients' financial abilities have been found to lack validity,

showing both over- and underestimates.⁴ Higher educational and sociocultural levels among caregivers have, however, been associated with more accurate reports.⁵

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As regards the BPSD, younger and less well-educated caregivers as well as those with more depression and greater burden have been found to report more BPSD.⁶ Female caregivers also seem to experience greater burden in relation to BPSD.⁷ In general, the findings indicate a low level of agreement between patient, relative, and formal caregiver reports of the patient's symptoms.^{8,9}

Anosognosia in the patient has been shown to increase burden in caregivers,¹⁰⁻¹³ leading them to underestimate the patient's capacities.^{14,15} The caregiver's evaluation may also be influenced by variables such as personality, general well-being, and the quality of relationship with the patient, and these factors may also produce a degree of bias in caregiver assessments.¹⁶

When it comes to evaluating the patient's quality of life (QoL-p), both burden¹⁷⁻²² and depression¹⁹⁻²⁴ in caregivers have been shown to produce a negative bias in their assessments. Likewise, burden and poor mental health in caregivers are inversely correlated with their perception of QoL-p.^{25,26} female caregivers give the most negative ratings of QoL-p,^{17,27} and they also present with more depression and anxiety.^{28,29}

In light of the above, the aim of the present study was to identify and quantify the caregiver factors that may lead to variability in their assessments of the patient's functional capacities, neuropsychiatric symptoms, anosognosia, and quality of life. Furthermore, these factors were examined in relation to the different stages of AD. The study hypothesis was that caregiver's burden, depression, gender, and health might all be related to the variability in caregiver assessments of patients' capacities.

To the best of our knowledge, this is the first study to conduct, in the same sample, a comparative analysis of the influence of caregiver factors on the assessment of 4 important areas of the capacities of patients with AD, doing so in relation to the level of impairment shown.

Methods

Design and Study Population

The design was an observational, cross-sectional, and analytic study. A consecutive sample was recruited from outpatients seen at the Dementia Unit of the Neurology Service of the Bellvitge University Hospital (Hospitalet de Llobregat, Spain). They were all diagnosed as having either AD according to Diagnostic and Statistical Manual of Mental Disorders criteria³⁰ or probable AD according to National Institute of Neurological and Communicative Disorders and Stroke/Alzheimer Disease and Related Disorders Associations criteria.³¹ The patients were excluded if they presented with vascular or traumatic events or alcohol or substance dependency or abuse. The main family caregiver was defined as the person who was responsible for helping the patient with activities of daily living (ADL). The study was approved by the hospital's clinical research ethics committee.

The sample comprised 221 patients and their respective family caregivers. On the basis of previous studies,^{10,17} this

sample size enabled us to detect, with a power of 84% and accepting an α risk of .05 and a β risk of .20 in a 2-tailed independent contrast, a difference of 4 points or more in the total score on the Disability Assessment for Dementia (DAD; standard deviation [SD] = 10), 8 points on the Neuropsychiatric Inventory (NPI; SD = 20), 6 points on the Anosognosia Questionnaire-Dementia (AQ-D; SD = 15), and 2 points on the Quality of Life in AD (QOL-AD; SD = 5). This sample size yielded a power of 99% to detect an effect size of 0.4 or higher in a multivariate linear regression with a maximum of 8 predictors, an α risk of .05, and a coefficient of determination of 0.3.

Measures

Clinical and Sociodemographic Data. Sociodemographic data for patients and caregivers were gathered using an ad hoc structured questionnaire.

Cognitive Assessment of the Patient. This was based on the Mini-Mental State Examination (MMSE),³² a brief cognitive assessment whose score ranges from 0 to 30 (the lower the score the greater the cognitive deterioration). This was administered directly to the patient.

Stage of Dementia. The criteria applied here were those of the Global Deterioration Scale (GDS). This is a clinical assessment scale designed to determine the stage of a patient's dementia.³³

Functional Assessment of the Patient. This was based on the DAD,³⁴ a measure of basic and instrumental ADL. The DAD comprises 40 items, and its total score ranges from 40 to 80 (the higher the score the greater the functional capacity). This assessment was based on the information provided by caregivers.

Behavioral and Psychological Symptoms of Dementia. This aspect was assessed by means of the NPI,³⁵ which comprises 12 subscales that assess the frequency and severity of 12 neuropsychiatric symptoms. This assessment was based on the information provided by the caregivers. Scores range from 0 to 144, and the higher the score the greater the frequency and severity of behavioral disorders.

Anosognosia of Patients. The AQ-D³⁶ comprises 30 items that refer to cognitive/functional deficits and personality changes, with each item being rated according to the frequency of occurrence, from 0 (never) to 3 (always). The total score therefore ranges from 0 to 90, with higher scores being indicative of greater anosognosia. Although the final score is derived by calculating the difference between caregiver and patient scores, for the purposes of the present study only the caregiver score was used, in order to determine the presence of rating variability.

Measure of Quality of Life. The QOL-AD scale is designed to assess the QoL-p.²⁰ Only the score from the caregiver's perspective was used here. The scale comprises 13 items that refer to different aspects of the patient's well-being. Scores for each

item range from 1 (poor) to 4 (excellent), yielding a total score between 13 and 52; the higher the score, the better the quality of life.

Depression. The Geriatric Depression Scale (GDS-d), in its 15-item format,³⁷ was directly administered to patients and caregivers. The cutoff score for probable depression is ≥ 6 .

Physical and Mental Health of Caregivers. This was assessed using the abbreviated version of the SF-36 Health Survey,³⁸ a 12-item instrument whose total score ranges from 12 to 28. It yields 2 global dimensions, physical and mental, on each of which the possible score ranges from 0 to 100 (the higher the score the better the respondent's health).

Caregiver Burden. This was assessed using the Zarit Burden Interview (ZBI),³⁹ which comprises 22 items that are scored on a Likert-type scale ranging from 1 (never) to 5 (almost always). The total score therefore ranges between 22 and 110, and the higher the score the greater the burden. The Spanish adaptation used here established a cut off of ≥ 46 for the presence of burden.⁴⁰

Procedure

Neurologists from the Dementia Unit identified eligible patients according to the inclusion criteria and determined their degree of dementia in terms of GDS stage.³³ The sample was recruited between January 2011 and July 2012. Of the total number of patients who met the inclusion criteria, only 6 families declined to participate.

In the initial study interview, the aims of the research were explained to patients and caregivers, and informed consent was obtained from all the participants. Patients and their caregivers were then interviewed separately by 2 psychologists trained in the administration of the respective tests and instruments.

Statistical Analysis

A descriptive analysis of the clinical and sociodemographic characteristics of the sample was carried out, using absolute and relative frequencies for qualitative variables and measures of central trend and dispersion for quantitative variables.

The influence of clinical and sociodemographic caregiver variables on caregiver assessments of patients' capacities (functional status, neuropsychiatric symptoms, anosognosia, and quality of life) was analyzed by means of parametric tests (analysis of variance [F] and the Student test [*t*]) and nonparametric tests (Mann Whitney *U* [*z*] and Kruskal-Wallis [χ^2]), in accordance with criteria of normality. When there was a significant difference between the 2 measures, Cohen *d* was calculated in order to determine the effect size. The bivariate analysis was conducted both for the sample as whole and according to GDS stage.

Finally, several multiple linear regression models were fitted, using the scores on the DAD, NPI, AQ-D, and QOL-

AD as dependent variables, and the clinical and sociodemographic factors of caregivers and patients, which were shown to be significant in the bivariate analysis as independent variables. The analyses were conducted using the Enter method (introducing all the variables in a single step). In the multiple linear regression analysis, the contribution coefficient (CC) for each variable was calculated by means of the solution suggested by Guilford and Fruchter: β coefficient \times the coefficient of correlation with the dependent variable.⁴¹

For hypothesis contrasts, the level of statistical significance was set at $P < .05$. All data processing and analysis were performed using SPSS version 17.0 for Windows.

Results

Description of the Sample

The study sample comprised 221 caregivers and their corresponding patients. The mean age was 63.8 ± 13.0 years for caregivers and 77.8 ± 7.3 years for patients. Women accounted for 68.3% ($n = 151$) of the caregivers and 63.3% ($n = 140$) of the patients.

Regarding the clinical data of caregivers, the mean score on the ZBI was 49.4 ± 15.5 , while that for depression (GDS-d) was 4.1 ± 3.3 .

The mean scores of caregivers in their assessment of the 4 areas of the patient's capacities were as follows: DAD, 58.1 ± 10.2 ; NPI, 25.3 ± 19.6 ; AQ-D, 49.1 ± 16.1 ; and QOL-AD, 27.3 ± 5.5 . As regards the severity of dementia, 97 (43.9%) patients met the criteria for GDS stage 4, 78 (35.3%) for GDS stage 5, and 46 (20.8%) for GDS stage 6. The remaining clinical characteristics of caregivers and patients are shown in Table 1.

Caregiver Assessments of Patient Capacities in the Global Sample

Caregiver's gender (women), greater burden (ZBI), more depression (GDS-d), and poorer mental health (SF-12) were all associated with more negative caregiver assessments of the patient's functional capacities (DAD), anosognosia (AQ-D), behavioral and psychological symptoms (NPI), and quality of life (QOL-AD).

The factor that produced the greatest variability in caregiver assessments was burden, this being the case for all the capacities that were evaluated. The effect size (*d*) was also important, ranging between .79 for scores on the DAD and 1.02 for the AQ-D. The next most relevant factor was depression, with a moderate effect size ($d = .52-.74$) in all the assessments. Smaller differences were observed in relation to caregiver's mental health ($d = .40-.50$) and gender ($d = .36-.50$). The complete data are shown in Table 2.

Caregiver Assessments of Patient Capacities According to GDS Stage

In order to analyze in greater detail the discrepancies between caregivers, the data were disaggregated according to the GDS

Table 1. Sociodemographic and Clinical Data of the Participants.

| Patients, N = 221 | | Caregivers, N = 221 | |
|---------------------------|------------------|--------------------------------|------------------|
| Age, years; median (IQR) | 78.6 (74.4-82.5) | Age, years; median (IQR) | 64.8 (53.0-76.2) |
| Gender (female), n (%) | 140 (63.3) | Gender (female), n (%) | 151 (68.3) |
| Level of education, n (%) | | Level of education, n (%) | |
| Illiterate/no schooling | 85 (38.5) | Illiterate/no schooling | 36 (16.3) |
| 1-4 years | 55 (24.9) | 1-4 years | 20 (9.0) |
| 5-8 years | 64 (29.0) | 5-8 years | 83 (37.6) |
| >8 years | 17 (7.7) | >8 years | 82 (37.1) |
| | | Family relationship, n (%) | |
| | | Spouse | 116 (52.5) |
| | | Son/daughter | 89 (40.3) |
| | | Other relative | 16 (7.2) |
| | | Living with the patient, n (%) | 177 (80.1) |
| Direct assessment | | Direct assessment | |
| MMSE, median (IQR) | 19.0 (15.0-22.5) | ZBI, median (IQR) | 48.0 (37.5-61.0) |
| GDS-d, median (IQR) | 3.0 (1.0-5.0) | GDS-d, median (IQR) | 3.0 (2.0-3.0) |
| GDS stage, n (%) | | SF-12, median (IQR) | 51.4 (39.9-55.7) |
| GDS 4 | 97 (43.9) | SF-12, median (IQR) | 47.1 (34.6-53.0) |
| GDS 5 | 78 (35.3) | | |
| GDS 6 | 46 (20.8) | | |
| Assessment by caregivers | | | |
| DAD, median (IQR) | 59.0 (49.0-66.5) | | |
| NPI, median (IQR) | 22.0 (12.0-32.0) | | |
| AQ-D, median (IQR) | 52.0 (38.0-61.0) | | |
| QOL-AD, mean (SD) | 27.3 (5.5) | | |

Abbreviations: IQR, interquartile range; SD, standard deviation; AQ-D, Anosognosia Questionnaire-Dementia; GDS-d, Geriatric Depression Scale; MMSE, Mini-Mental State Examination; DAD, Disability Assessment for Dementia; NPI, Neuropsychiatric Inventory; QOL-AD, Quality of Life-Alzheimer disease; ZBI, Zarit Burden Interview; SF-12, Short Form of Health Survey; GDS, Global Deterioration Scale.

stage of the patients, the aim being to obtain homogeneous groups of patients as regards their degree of deterioration (Table 3).

This analysis revealed that it was in relation to patients with early-stage dementia (GDS 4) that caregiver factors had the greatest influence on the variability of assessments. Caregiver's burden was again the most significant factor as regards the observed variability, with very important effect sizes ($d = 1.02-1.25$). In contrast, depression in the caregiver was not associated with any significant differences in caregiver assessments of early-stage patients. Female caregivers gave more negative assessments on the DAD ($d = .55$) and NPI ($d = .51$), while those caregivers with poorer health (SF-12) gave more negative ratings on the NPI (physical, $d = .47$; mental, $d = .82$) and QOL-AD (physical, $d = .63$; mental, $d = .52$).

In the analysis of assessments of patients with moderate and severe dementia, only greater burden and depression in the caregiver remained significant variables. Due to the small number of participants involved, we also conducted an analysis of GDS stages 5 and 6 combined. The results confirmed (1) that caregivers with greater burden gave more negative ratings on the NPI ($d = .81$), the AQ-D ($d = .59$), and the QOL-AD ($d = .48$), and (2) that caregivers with higher levels of depression gave more negative ratings on all the measures, the DAD ($d = .38$), NPI ($d = .69$), AQ-D ($d = .57$), and the QOL-AD ($d = .55$). The data for all the stages disaggregated can be consulted in Supplementary Table 1s.

Sociodemographic Caregiver Variables

Most of the caregiver variables (age, years of schooling, living with the patient, working outside the home, and having other dependents) were not associated with significant differences in relation to the assessment of the patient capacities. In fact, the only sociodemographic variable that had a significant influence on the variability of assessments was gender. The bivariate analysis of the global data showed that female caregivers, and especially daughters (Table 2), gave a more negative assessment of patients than did male caregivers, although this difference was not always significant when the data were disaggregated by GDS stage or in the regression analysis.

Overall, the caregiver factors associated with female gender were younger age (men = 68.8 ± 12.5 vs women = 61.4 ± 12.5 ; $z = 3.9$, $P < .001$, $d = .59$), poorer mental health (men = 48.0 ± 10.9 vs women = 41.1 ± 12.3 ; $z = 4.3$, $P < .001$, $d = .59$), poorer physical health (men = 51.2 ± 9.1 vs women = 45.8 ± 11.2 ; $z = 3.4$, $P = .001$, $d = .52$), greater burden (men = 44.8 ± 16.2 vs women = 51.5 ± 14.7 ; $z = 3.3$, $P = .001$, $d = .43$), and more hours per day spent caring for the patient (men = 4.7 ± 4.1 vs women = 6.0 ± 3.7 ; $z = 2.7$, $P = .007$, $d = .33$). Depression was also present more among female spouse caregivers, when compared with both husbands (husbands = 3.5 ± 2.9 vs wives = 5.2 ± 3.6 ; $z = 2.5$, $P = .010$, $d = .52$) and daughters (daughters = 3.9 ± 3.2 vs wives = 5.2 ± 3.6 ; $z = 2.1$, $P = .029$, $d = .38$).

Table 2. Patient Assessment by Caregivers, According to Caregiver Factors: All Cases.

| Caregiver Factors | n | DAD, Mean \pm SD | NPI, Mean \pm SD | AQ-D, Mean \pm SD | QOL-AD, Mean \pm SD |
|-------------------------|-----|--------------------|--------------------|---------------------|--------------------------------|
| Gender | | | | | |
| Men | 70 | 60.9 \pm 10.8 | 20.6 \pm 18.5 | 44.9 \pm 16.5 | 29.1 \pm 5.2 |
| Women | 151 | 56.8 \pm 9.6 | 27.5 \pm 19.7 | 51.1 \pm 15.6 | 26.4 \pm 5.5 |
| z (P); d | | 2.8 (.005); .40 | 2.8 (.004); .36 | 2.5 (.01); .38 | 3.4 (.001) ^a ; .50 |
| Family relationship | | | | | |
| Sons | 19 | 61.9 \pm 12.5 | 14.4 \pm 15.9 | 41.6 \pm 16.1 | 29.8 \pm 5.9 |
| Husbands | 51 | 60.6 \pm 10.2 | 22.9 \pm 19.0 | 46.1 \pm 16.7 | 28.9 \pm 4.9 |
| Wives | 65 | 57.8 \pm 9.9 | 26.0 \pm 21.8 | 49.2 \pm 16.7 | 26.9 \pm 5.7 |
| Daughters | 70 | 55.7 \pm 9.7 | 28.7 \pm 18.5 | 53.0 \pm 15.1 | 26.3 \pm 5.6 |
| χ^2 (P); η^2 | | 9.5 (.02); .04 | 13.2 (.004); .06 | 10.1 (.01); .05 | 3.5 (.01) ^b ; .05 |
| ZBI (burden) | | | | | |
| ≤ 46 | 101 | 62.2 \pm 10.3 | 15.8 \pm 11.4 | 41.0 \pm 15.8 | 30.0 \pm 5.2 |
| > 46 | 120 | 54.6 \pm 8.7 | 33.2 \pm 21.4 | 55.9 \pm 13.0 | 25.0 \pm 4.8 |
| z (P); d | | 5.6 (<.001); .79 | 7.1 (<.001); 1.01 | 6.7 (<.001); 1.02 | 7.3 (<.001) ^a ; .99 |
| GDS-d (depression) | | | | | |
| < 6 | 161 | 59.5 \pm 9.9 | 21.2 \pm 15.9 | 46.5 \pm 15.6 | 28.2 \pm 5.3 |
| ≥ 6 | 60 | 54.3 \pm 10.0 | 36.3 \pm 23.9 | 56.2 \pm 15.4 | 24.9 \pm 5.6 |
| z (P); d | | 3.4 (.001); .52 | 4.6 (<.001); .74 | 4.2 (<.001); .62 | 4.0 (<.001) ^a ; .60 |
| SF-12 (mental health) | | | | | |
| < 50 | 139 | 56.6 \pm 10.0 | 28.8 \pm 19.7 | 51.8 \pm 15.6 | 26.3 \pm 5.4 |
| ≥ 50 | 82 | 60.6 \pm 10.0 | 19.3 \pm 17.8 | 44.6 \pm 16.0 | 29.0 \pm 5.4 |
| z (P); d | | 2.7 (.005); .40 | 4.1 (<.001); .50 | 3.2 (.001); .45 | 3.4 (.001) ^a ; .50 |
| SF-12 (physical health) | | | | | |
| < 50 | 95 | 58.1 \pm 9.6 | 26.9 \pm 20.0 | 49.9 \pm 16.1 | 26.5 \pm 5.2 |
| ≥ 50 | 126 | 58.1 \pm 10.6 | 24.1 \pm 19.3 | 48.6 \pm 16.2 | 27.9 \pm 5.7 |
| z (P); d | | 0.08 (.93) | 1.1 (.24) | 0.3 (.70) | 1.9 (.05) ^a |

Abbreviations: DAD, Disability Assessment for Dementia; NPI, Neuropsychiatric Inventory; AQ-D, Anosognosia Questionnaire-Dementia; QOL-AD, Quality of Life-Alzheimer disease; ZBI, Zarit Burden Interview; GDS-d, Geriatric Depression Scale; SF-12, Short Form of Health Survey; z, Mann-Whitney U; χ^2 , Kruskal Wallis (3); d, Cohen d; η^2 , eta square.

^at, Student t test (219).

^bF, analysis of variance (3201).

Multiple Linear Regression Analysis

In the regression analysis, caregiver burden was associated with a negative assessment in all areas, and it was the factor that contributed mostly to the observed variance. Greater depression was also associated with more negative assessments on the NPI. In fact, the greatest variability was observed in relation to neuropsychiatric symptoms, while the least corresponded to functional capacities. Although depression and mental health did not appear to be very significant in the regression analysis, there was a notable correlation (Spearman coefficient) between caregiver burden and both these variables (depression: $r_s = .49$, $P < .001$; mental health: $r_s = -.50$, $P < .001$).

In patients, the greatest variability was associated with GDS stage for all the assessments. The contrast carried out to determine the relative influence of caregiver and patient factors, estimated by means of the CC, showed that caregiver factors were associated with greater variance in scores on the NPI (caregivers = 37.4% vs patients = 9.8%) and QoL-AD (caregivers = 27.2% vs patients = 20.0%), whereas patient factors were more relevant in relation to the DAD (caregivers = 10.3% vs patients = 59.8%) and the AQ-D (caregivers = 21.6% vs patients = 44.5%; Table 4).

Discussion

Influence of Caregiver Factors on Patient Assessments

In all previous studies of discrepancies in caregiver assessments of patient's capacities,^{10,17,25,26,42} the greatest variability was attributed to the status of patients themselves. As a complement to this research, the present study sought to determine whether certain caregiver factors (gender, burden, depression, and health) might also be related to the variability in these assessments.

The results obtained confirm the proposed hypothesis regarding the influence of caregiver factors on the scales and tests used to assess different aspects of the patient with AD. Caregiver burden was the most important factor as regards the variability in caregiver assessments, most notably in relation to early-stage patients with dementia. The observed effect was always in the same direction, namely the greater the burden the more negative the patient assessment. These results highlight that caring for the patient with Alzheimer implies a degree of burden that can lead to important subjective changes in caregiver perceptions. In general, previous studies have also reported that caregiver burden is associated with a more negative assessment of the patient's functional capacities,^{2,3}

Table 3. Patient Assessment by Caregivers, According to Caregiver Factors and GDS Stages.^a

| Caregiver factors | n | DAD, Mean \pm SD | NPI, Mean \pm SD | AQ-D, Mean \pm SD | QOL-AD, Mean \pm SD |
|-------------------|----|-------------------------------|-------------------------------|-------------------------------|---------------------------------------------|
| GDS 4 | | | | | |
| Gender | | | | | |
| Men | 38 | 68.6 \pm 5.5 | 12.9 \pm 10.3 | 34.4 \pm 12.1 | 31.5 \pm 4.6 |
| Women | 59 | 65.2 \pm 6.7 | 19.5 \pm 15.0 | 38.4 \pm 13.3 | 29.5 \pm 5.6 |
| z (P); d | | 2.3 (.02); .55 | 2.1 (.03); .51 | 1.4 (.15) | 1.8 (.06) ^b |
| ZBI | | | | | |
| ≤ 46 | 60 | 68.8 \pm 5.2 | 11.8 \pm 8.3 | 32.0 \pm 11.0 | 32.5 \pm 4.3 |
| > 46 | 37 | 62.7 \pm 6.6 | 25.2 \pm 16.5 | 44.7 \pm 11.9 | 26.7 \pm 4.9 |
| z (P); d | | 4.3 (<.001); 1.02 | 4.3 (<.001); 1.02 | 4.4 (<.001); 1.10 | 6.0 (<.001) ^b ; 1.25 |
| GDS-d | | | | | |
| ≤ 6 | 80 | 66.7 \pm 6.5 | 15.5 \pm 12.4 | 36.2 \pm 12.6 | 30.6 \pm 5.3 |
| > 6 | 17 | 65.8 \pm 6.2 | 23.3 \pm 17.6 | 39.7 \pm 14.2 | 29.0 \pm 4.9 |
| z (P); d | | 0.5 (.55) | 1.7 (.07) | 0.9 (.35) | 1.1 (.25) ^b |
| SF-12 mental | | | | | |
| ≤ 50 | 54 | 65.5 \pm 7.0 | 21.4 \pm 15.1 | 39.2 \pm 13.8 | 29.1 \pm 5.2 |
| > 50 | 43 | 67.8 \pm 5.5 | 11.2 \pm 8.9 | 33.9 \pm 11.1 | 31.8 \pm 5.0 |
| z (P); d | | 1.6 (.09) | 3.6 (<.001); .82 | 1.8 (.06) | 2.5 (.01) ^b ; .52 |
| SF-12 physical | | | | | |
| ≤ 50 | 43 | 65.0 \pm 7.1 | 20.5 \pm 15.5 | 39.2 \pm 13.8 | 28.5 \pm 5.0 |
| > 50 | 54 | 67.8 \pm 5.7 | 14.1 \pm 11.4 | 35.0 \pm 12.0 | 31.7 \pm 5.1 |
| z (P); d | | 1.8 (.06) | 2.1 (.03); .47 | 1.4 (.14) | 3.0 (.003) ^b ; .63 |
| GDS 5-6 | | | | | |
| Gender | | | | | |
| Men | 32 | 51.8 \pm 8.1 | 29.7 \pm 21.9 | 57.4 \pm 11.8 | 26.3 \pm 4.4 |
| Women | 92 | 51.4 \pm 7.0 | 32.6 \pm 20.7 | 59.2 \pm 10.9 | 24.5 \pm 4.5 |
| z (P); d | | 0.1 (.90) | 0.8 (.40) | 0.4 (.67) | 1.8 (.06) ^b |
| ZBI | | | | | |
| ≤ 46 | 41 | 52.6 \pm 8.1 | 21.8 \pm 12.9 | 54.3 \pm 12.1 | 26.4 \pm 4.2 |
| > 46 | 83 | 51.0 \pm 6.8 | 36.8 \pm 22.5 | 60.9 \pm 10.0 | 24.3 \pm 4.5 |
| z (P); d | | 0.9 (.32) | 4.1 (<.001); .81 | 3.1 (.002); .59 | 2.4 (.01) ^b ; .48 |
| GDS-d | | | | | |
| ≤ 6 | 81 | 52.5 \pm 7.2 | 26.7 \pm 17.1 | 56.6 \pm 11.1 | 25.8 \pm 4.0 |
| > 6 | 43 | 49.7 \pm 7.2 | 41.4 \pm 24.3 | 62.7 \pm 10.2 | 23.3 \pm 5.0 |
| z (P); d | | 2.1 (.02); .38 | 3.5 (<.001); .69 | 3.1 (.002); .57 | 2.7 (.007) ^b ; .55 |
| SF-12 mental | | | | | |
| ≤ 50 | 85 | 51.0 \pm 7.2 | 33.5 \pm 21.0 | 59.8 \pm 10.7 | 24.6 \pm 4.7 |
| > 50 | 39 | 52.5 \pm 7.5 | 28.3 \pm 20.9 | 56.4 \pm 11.8 | 25.8 \pm 4.1 |
| z (P); d | | 1.0 (.30) | 1.5 (.11) | 1.3 (.19) | 1.4 (.14) ^b |
| SF-12 physical | | | | | |
| ≤ 50 | 52 | 52.5 \pm 7.6 | 32.2 \pm 21.8 | 58.7 \pm 12.2 | 24.8 \pm 4.7 |
| > 50 | 72 | 50.8 \pm 7.0 | 31.6 \pm 20.6 | 58.7 \pm 10.4 | 25.1 \pm 4.4 |
| z (P); d | | 1.1 (.24) | 0.1 (.85) | 0.2 (.81) | 0.4 (.67) ^b |

Abbreviations: DAD, Disability Assessment for Dementia; NPI, Neuropsychiatric Inventory; AQ-D, Anosognosia Questionnaire-Dementia; QOL-AD, Quality of Life-Alzheimer disease; ZBI, Zarit Burden Interview; GDS-d, Geriatric Depression Scale; SF-12, Short Form of Health Survey; GDS, Global Deterioration Scale; z, Mann-Whitney U; (df), degrees of freedom, GDS 4 (95), GDS 5-6 (122); d, Cohen d.

^aP values <.05 are shown in bold.

^bt, Student t test.

neuropsychiatric symptoms,^{2,6} anosognosia,¹⁴ and quality of life.¹⁷⁻²²

In contrast to the results of burden, depression in the caregiver did not influence the assessments of early-stage patients, although there was an effect for those with mid-stage dementia. The fact that depression in the caregiver is associated only with the variability of assessments in relation to more advanced dementia that could be due to the greater impairment of these patients, which might lead not only to a greater sense of loss among caregivers but also to more depressive feelings as a

result of prolonged exposure to a stressful situation. Generally speaking, previous studies have also reported an association between caregiver depression and more negative assessments of the patient's functional capacities,¹ neuropsychiatric symptoms,⁶ and quality of life.¹⁹⁻²⁶

Caregiver gender had less of an influence than both burden and depression. In general, however, women, and especially daughters, gave more negative assessments of the patient's capacities. Furthermore, burden, depression, and poorer mental and physical health were more commonly reported by female

Table 4. Multiple Linear Regression Analysis.

| | DAD | | | NPI | | | AQ-D | | | QOL-AD | | |
|--------------------|---------------------|-------|-------|---------------------|------|-------|---------------------|-----|-------|---------------------|------|-------|
| | $R^2 = .701$ | | | $R^2 = .472$ | | | $R^2 = .661$ | | | $R^2 = .472$ | | |
| All cases, N = 221 | β | t | P | β | t | P | β | t | P | β | t | P |
| Caregiver factors | | | | | | | | | | | | |
| ZBI (burden) | -.23 | -4.6 | <.001 | .49 | 7.4 | <.001 | .40 | 7.5 | <.001 | -.44 | -6.7 | <.001 |
| GDS-d (depression) | -.01 | -0.2 | .827 | .17 | 2.5 | .010 | .01 | 0.2 | .821 | -.08 | -1.2 | .206 |
| SF-12 (mental) | -.11 | -2.2 | .026 | .08 | 1.2 | .200 | .09 | 1.8 | .068 | -.18 | -2.6 | .008 |
| Gender (men) | -.08 | -2.2 | .028 | .04 | 0.8 | .396 | .07 | 1.6 | .100 | -.11 | -2.0 | .038 |
| CC (Σ), % | 10.3 | | | 37.4 | | | 21.6 | | | 27.2 | | |
| Patient factors | | | | | | | | | | | | |
| GDS stage | -.69 | -14.5 | <.001 | .19 | 3.1 | .002 | .49 | 9.8 | <.001 | -.35 | -5.6 | <.001 |
| GDS-d (depression) | -.06 | -1.5 | .114 | .01 | 0.3 | .719 | .03 | 0.9 | .345 | -.17 | -3.4 | .001 |
| MMSE (cognition) | .07 | 1.7 | .089 | -.03 | -0.5 | .568 | -.15 | 3.1 | .002 | -.00 | -0.1 | .906 |
| Schooling | .00 | 0.1 | .855 | .08 | 1.5 | .113 | -.08 | 2.0 | .046 | -.01 | -0.3 | .708 |
| CC (Σ), % | 59.8 | | | 9.8 | | | 44.5 | | | 20.0 | | |
| F (df), P | 61.9 (8,212), <.001 | | | 23.6 (8,212), <.001 | | | 51.6 (8,212), <.001 | | | 23.7 (8,212), <.001 | | |

Abbreviations: DAD, Disability Assessment for Dementia; NPI, Neuropsychiatric Inventory; AQ-D, Anosognosia Questionnaire-Dementia; QOL-AD, Quality of Life-Alzheimer disease; ZBI, Zarit Burden Interview; GDS-d, Geriatric Depression Scale; SF-12, Short Form of Health Survey; GDS, Global Deterioration Scale; MMSE, Mini-Mental State Examination; CC, contribution coefficient; F, analysis of variance; (df), degrees of freedom; R^2 , Determination coefficient; β , standardized beta coefficient; t, Student t test; CC (Σ), sum of contribution coefficient (%), $[(\beta \div r) \times 100]$.

caregivers. These findings are consistent with previous research, which has found greater burden and more psychiatric symptoms among female caregivers,^{28,29,43-45} who also gave more negative assessments of the patient's neuropsychiatric symptoms⁷ and quality of life.^{17,27} These gender differences could be due to men paying less attention to their emotions or to women using less effective coping strategies.⁴⁶ At all events, the present data also indicate that women have a greater involvement in caregiving tasks.

Variability in Caregiver Assessments of Patient Capacities

The greater variability observed in the assessment of patients with early-stage dementia may, at first sight, seem paradoxical, unless one considers the subjective aspects of caregiving. Specifically, this greater variability, associated with higher levels of burden and poorer mental health, could be due to the greater impact that dementia has on the caregiver in the early stages, whereas by the time the patient has developed mid-stage dementia, the caregiver may have become somewhat accustomed to the impairment and be better able to adapt to the situation. In line with the present results, 1 previous study found that spouse assessments of anosognosia were more severe in the group of patients with early-stage dementia, when compared with the mid-stage dementia group.⁴⁷

The least variability in caregiver assessments of patient capacities was observed in relation to functional capacities and anosognosia. Given that the AQ-D places greater emphasis on the awareness of cognitive and functional deficits than that of behavioral and psychological symptoms, one can speculate that it is easier for caregivers to be more objective about a functional deficit than a behavioral symptom, as the former has a greater impact.⁴⁸

Neuropsychiatric symptoms were associated with greater variability in caregiver assessments, probably due to their greater impact on caregivers. Various studies have highlighted the extent to which behavioral disorders in the patient can affect caregivers.^{43,48,49} In one study of caregiver assessments of depression in the patient, caregiver variables accounted for 33% of the variance, with caregiver depression and burden being the most relevant factors.⁵⁰

In the present study, the assessment of the QoL-p also showed considerable variability, most likely due to the high degree of subjectivity that is inherent within it, in addition to the associated factors such as caregiver burden and depression.^{21-24,27,28}

Conclusions

The results of this study confirm that certain factors associated with caregivers may lead them to give more negative assessments of the capacities of patients with AD. These more negative ratings are most notable in relation to assessments based on the NPI and QOL-AD and less so for the AQ-D and DAD. Caregiver burden and depression were the most relevant factors and were more present among female caregivers. Consequently, it would be advisable to treat with caution any assessments of patient capacities that are made by caregivers with these characteristics.

A further conclusion to be drawn is that dementia units would do well to encourage family caregivers to take advantage of support groups, such as those offered by the Alzheimer Association. By helping caregivers to develop a better understanding of the disease and to adapt to its implications, these groups can also assist in reducing burden and depression, which

may in turn lead caregivers to have a more positive view of the patient's capacities.

The main limitation of this study is the lack of a genuine longitudinal perspective that would enable the effect of caregiver factors on patient assessments to be observed over time. A further limitation is that the analysis did not include a direct assessment by professionals of the patients' capacities. Were this to have been available, it would have been possible to compare the assessments of professionals with those of family caregivers, thereby enabling a more detailed analysis of potential bias. In future studies, we aim to overcome this limitation by including independent observations.

Authors' Note

The research was conducted at the Dementia Unit (Department of Neurology) of Bellvitge University Hospital (Spain) and was approved by the hospital's ethics committee. The study was conducted within the framework of the project Assessing perceptions of patient's quality of life in patients with Alzheimer disease and their family caregivers over a 2-year period.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Supplementary Table 1s. Patient Assessment by Caregivers, According to Caregiver Factors and GDS Stages (4, 5, and 6).