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Predictors of Quality of Life Ratings for Persons with Dementia Simultaneously Reported by Patients and their Caregivers: The Cache County (Utah) Study

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Abstract

Background—Quality of Life (QOL) is frequently assessed in persons with dementia (PWD) via self- and/or proxy-report. Determinants of QOL ratings are multi-dimensional and may differ between patients and caregiver proxies. This study compares self-report and proxy QOL ratings in a population-based study of PWD and their caregivers, and examined the extent to which discrepancies in reports were associated with characteristics of the PWD.

Methods—The sample consisted of 246 patient/caregiver dyads from the initial visit of the Cache County Dementia Progression Study, with both members of the dyad rating PWD QOL. PWD age, gender, cognitive impairment (Mini-Mental State Exam), neuropsychiatric symptoms (Neuropsychiatric Inventory; NPI), dementia severity (Clinical Dementia Rating), medical comorbidities (General Medical Health Rating), and functional impairment (Dementia Severity Rating Scale) were examined as correlates of self- and proxy-reported QOL ratings and the differences between the QOL reports.

Results—Self- and proxy-reported PWD QOL ratings were only modestly correlated. Medical comorbidity was associated with self-report whereas NPI was associated with proxy-report. Dementia severity was associated with discrepancies in self- and proxy-report, with worse patient cognition associated with poorer proxy-reported QOL ratings.

Conclusions—PWD self- and proxy-reported QOL ratings are associated with different variables. Discrepancies between PWD and caregiver perceptions of PWD QOL should be recognized, particularly in cases of more severe dementia.

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Conflicts of Interest

None.

Description of Authors' Roles

Drs. Morrison, Buckley, Tschanz, and Lyketsos were primarily responsible for formulating research questions and drafting the original article. Drs. Buckley, Fauth, and Tschanz were responsible for the revision of the manuscript. Drs. Buckley and Tschanz provided expertise in statistical analysis. Drs. Rabins, Piercy, and Norton reviewed the article for intellectual content and provided suggestions for relevant literature where appropriate. Dementia Progression Study senior contributors are Drs. Lyketsos and Tschanz.

Introduction

Maximizing the Quality of life (QOL) of persons with dementia (PWD) is a major goal of care and a primary outcome of intervention studies (Weyerer and Schäufele, 2003). The World Health Organization (WHO, 1995) has defined QOL as people's perceptions of their health, considering their culture, values, goals, and expectations. Researchers suggest that QOL extends beyond subjective perception and must include objective measures such as behaviors, social observations, and functional independence (Lawton, 1991).

Typically QOL ratings are based on self-report because this approach emphasizes the subjective nature of the person's experience. In the case of dementia, self-reported QOL has been lauded for respecting the autonomy and voice of the person with dementia. Self-reported PWD QOL seems particularly appropriate for individuals in mild-to-moderate stages of dementia (Logsdon *et al.*, 2002).

In cases of more advanced dementia, self-report of QOL may be unreliable due to patients' deterioration in language, comprehension, and levels of awareness (Albert *et al.*, 1996). When the subjective world of the person with dementia is not accessible, proxy reports from caregivers and health-care providers can provide important and valid information on global QOL, as well as specific characteristics, such as health, function, and behavior. Albert and colleagues (1996) used proxy reports of positive affect and higher activity to define higher ratings of QOL in persons with severe dementia, and found that greater cognitive and physical function and the absence of psychiatric symptoms predicted higher proxy rated PWD QOL. Corder and colleagues (2010) reported that higher levels of PWD QOL (as rated by nursing home staff proxy reports) correlated with higher cognitive function and fewer behavioral disturbances in the PWD, as well as whether or not the PWD was receiving pain medication.

Despite the success and necessity of proxy PWD QOL measures, there is some evidence that proxy reports may include measurement bias. Studies have repeatedly found that when QOL ratings for PWD are reported by both the PWD and a proxy, proxy reports of PWD QOL levels are significantly lower than the PWD self-report (Hoe *et al.*, 2007). These lower proxy QOL ratings are predicted by proxy depression, stress, and increased perception of caregiver burden (Logsdon *et al.*, 2002; Karlawish *et al.*, 2001; Sands *et al.*, 2004; Shiffczyk *et al.*, 2010), as well as kin relationship of the proxy to the PWD. Larger proxy and patient discrepancies emerged when proxy reporters were adult offspring caregivers, as opposed to spousal caregivers (Novella *et al.*, 2001). This same study also reported that larger discrepancies in proxy and PWD QOL reports were increased with greater cognitive impairment in the PWD.

The current study examined the role of PWD characteristics in explaining proxy and self-report QOL differences. First, we examined whether or not there were significant differences in QOL ratings in a large population-based sample of PWD and their caregivers. We hypothesized that even in our non-clinical community-based sample, proxy and self-reported QOL reports will differ. We examined whether differences between PWD-rated and proxy rated QOL were explained by characteristics of the person with dementia, and hypothesized that PWD health and dementia severity, cognitive and physical function and behavioral symptoms would be associated with differences in proxy and self-reported PWD QOL.

Methods

Participants

Participants in the current study were part of the Cache County Dementia Progression Study (DPS), a subset of persons with dementia recruited from the parent Cache County Memory Study (CCMS). CCMS was a population-based sample of elderly residents of Cache County, Utah, aged 65 and older as of January 1st, 1995 (N = 5,677). A detailed description of the recruitment, procedures and methods used in CCMS and the DPS have been reported previously (Breitner *et al.*, 1999; Tschanz *et al.*, 2011); in brief, all CCMS participants were screened for dementia using an in-depth, multi-stage protocol involving a panel of experts (Breitner *et al.*, 1999) and were reassessed using a similar protocol at three subsequent waves over 10–12 years. Individuals in CCMS diagnosed with incident dementia (i.e., identified within two-three years of their dementia onset) were invited to enroll in the DPS and followed every six months thereafter by a research nurse and neuropsychological technician to characterize the course of dementia progression and its predictors. Their caregivers were also invited to participate in the DPS study. The current study uses information from 164 care dyads at DPS initial visit.

Procedures

As part of DPS, both patients (self rating) and their caregivers (proxy rating) participated in a comprehensive battery of assessments. For the current study, variables related to QOL of PWD, dementia severity, and functional level of the PWD are relevant to analyses, and are described below.

Measures

Quality of Life—PWD and their caregivers were asked to rate the QOL of each dementia participant on a 5-point Likert scale, with values ranging from (1) “excellent,” (2) “good,” (3) “fair,” (4) “poor,” and (5) “very bad.” Twenty-three percent of PWD rated their QOL as “excellent,” while 58% gave a rating of “good,” 16% gave a rating of “fair,” 3% gave a rating of “poor,” and less than 1% rated their QOL as “very bad.” While various QOL measures have been included in research on dementia (for a review see Black and Rabins, 2005), single item global measures of QOL have also been utilized in a variety of studies of persons with dementia (Katsuno, 2005) and demonstrate reliability and validity in non-demented (de Boer *et al.*, 2004) and demented samples (Lucas Carrasco and March, 2010). The advantage of using a global measure of QOL is that alternative measures which include specific subscales related to impairment, disease severity, and behavioral symptoms overlap significantly with the predictor variables of interest in the current analyses.

Twelve percent of informant QOL ratings (of PWD’s QOL) fell into the “excellent” category, 50% fell into the “good” category, 27% fell into the “fair” category, 8% fell into the “poor” category, and 4% fell into the “very poor” category. Cross tabulations of these frequencies were calculated and are displayed in Table 1. Few subjects rated QOL in the fair, poor, and very bad categories. Thus, these three categories were combined, leaving three levels of ratings: “excellent,” “good,” and “fair, poor, or very bad.” The “fair/poor/very poor” category was used as the reference group, similar to the approach of Helvik and colleagues (2011) in their sample of non-demented older adults. To examine discrepancies between PWD self-rated QOL and caregiver proxy-rated QOL for the patient, difference scores were computed and used as the dependent variable in multiple regression models (with positive difference scores indicating PWD ratings were higher than proxy ratings).

Covariates—Age of dementia onset, education, and gender of the PWD were included in the analyses as covariates. The remaining scales below describe independent variables of interest, related to health and functioning in the PWD.

Cognition—Mini-Mental State Examination (MMSE) is a global measure of cognitive ability, assessing attention, memory, orientation, language and visuospatial ability. The overall score ranges from 0–30 (Folstein *et al.*, 1975). This widely used scale was administered to dementia participants to provide a global assessment of cognitive impairment.

Daily functioning—The Dementia Symptoms Rating Scale (DSRS) is a caregiver-rated measure of functional ability in the areas of: memory, language, community and home affairs, and basic care (Clark and Ewbank, 1996). Scores range from 0 – 61 points, with higher scores indicating worse functioning.

Neuropsychiatric (behavioral) symptoms—The Neuropsychiatric Inventory (NPI) is a caregiver rating that assesses neuropsychiatric symptoms (NPS) in dementia in 12 domains. If endorsed, each symptom was rated according to frequency and intensity. These scores were multiplied to yield individual symptom scores. A total score across all 12 symptoms was calculated (range from 0 – 144 points) such that higher scores indicated worse symptoms (Cummings *et al.*, 1994).

Dementia severity—The Clinical Dementia Rating (CDR) is a structured clinician rating of dementia. Scores in 6 areas are combined to obtain a composite score ranging from 0 through 5 (Morris, 1997). For analyses, we used the *Sum of Boxes* score, a global score summing across each domain (range from 0 – 30 points; higher scores indicate greater impairment). Our study used the sum of boxes method for the CDR because it is more sensitive to cognitive changes in mild cognitive impairment and dementia than the composite CDR score (Pavlik *et al.*, 2006)

Medical co-morbidity—The General Medical Health Rating (GMHR; Lyketsos *et al.*, 1999) is a clinician assessment of severity of medical co-morbidity in dementia patients. GMHR scores were rated as “excellent, good, fair, or poor.”

Statistical Methods

Spearman correlation coefficients were calculated to explore the relationship between ratings of QOL, demographic information and assessment questionnaires. Polychotomous logistic regression (LR) models were then estimated to examine relationships between independent variables and patient QOL ratings by study participants or their caregivers. Independent variables included education, age at dementia onset (determined as the age when the participant first met DSM-III-R criteria for dementia), gender, MMSE, DSRS, CDR, NPI, and GMHR scores.

To assess predictors of differences between patient self- and caregiver proxy QOL, the difference between patient self-ratings and caregiver proxy QOL ratings was computed for each participant and utilized as the dependent variable in a multiple linear regression model regressed on the same independent variables.

Results

There were 246 participants at initial visit. Table 2 displays sociodemographic and other relevant aggregate descriptors of the sample. Of these 246 dyads, 82 (33%) had some level

of missing data on the QOL measures and were not included in the current analyses. Specifically, 64 dyads (26%) had missing proxy-reported PWD QOL, 9 dyads (3.7%) had missing QOL data on both proxy and self-reported QOL measures, and 9 dyads (3.7%) had missing PWD self-reported QOL data. The final sample for analyses was 164. A comparison between those with missing data vs. those with complete data revealed that these groups did not differ at a level of $p < 0.05$ on PWD gender (all categorical variables tested using χ^2), or mean age of dementia onset, years of education, or mean neuropsychiatric symptoms (t-tests), or caregiver gender, kin relationship, frequency of caregiving (all categorical variables tested using χ^2), mean age, or mean years of education (t-tests). However dyads with missing QOL data were lower on mean PWD MMSE scores [t ($df = 92.53$) = -7.4 , $p < 0.001$] and higher on CDR scores [t ($df = 96.52$) = 6.68 , $p < 0.010$]; i.e. greater functional impairment].

Percent agreement between patient QOL and proxy QOL

Using the original QOL variable (where categories of fair, poor, and very bad are kept separate), 44% of dyads ($N = 73$ out of 164; see Table 1) had congruent responses on their ratings of PWD. Proxy reports were lower than self-reports for 41% of dyads ($N = 67$), and proxy reports were higher than self-reports for 15% of dyads ($N = 24$). A Spearman's rho correlation of the proxy- and self-reported QOL scores yielded a statistically significant association between the reports ($\rho = 0.289$; $p < 0.01$).

Predictors of patient QOL self-ratings

Table 3 displays results of polychotomous logistic regression, with patient QOL-ratings as the dependent variable. Results are shown as Odds Ratios (OR), with 95% confidence intervals, predicting "excellent" or "good" ratings compared to "fair, poor, or very bad" ratings. In univariable models, the following were predictors of higher QOL ratings: higher GMHR (better general health), fewer NPS on NPI, better functional ratings on DSRS, and higher MMSE. These variables significantly predicted the "excellent" ratings from the "fair, poor, very bad" ratings. Predicting "good" ratings from the "fair, poor, very bad" ratings was GMHR. In the multivariable model only GMHR score significantly distinguished "excellent" and "good" ratings from "fair, poor, very bad" ratings.

Predictors of caregiver ratings of patient QOL

Table 4 displays results of polychotomous logistic regression, predicting caregiver ratings of patient QOL from the predictor variables. Results are shown as Odds Ratios (OR), with 95% confidence intervals, predicting "excellent" or "good" ratings compared to "fair, poor, or very bad" ratings. In the univariable models the following were predictors of higher QOL ratings: higher GMHR scores (better general health), higher education, fewer NPS on the NPI, better functional ratings on DSRS, higher MMSE, and lower CDR. These variables significantly predicted the "excellent group" from the "fair, poor, very bad" group, and the "good" from the "fair, poor, very bad" group, with the exception of GMHR and education that only predicted "excellent" ratings from the reference. In the multivariable model, NPI distinguished "good" ratings from "fair, poor, very bad" ratings. More education and higher GMHR score significantly distinguished "excellent" ratings from "fair, poor, very bad" ratings.

Predictors of differences in self-reported vs. proxy-reported QOL ratings are displayed in Table 5. In the univariable models, gender, NPI, DSRS, and CDR-SB all significantly predicted the outcome variable. In the multiple regression model using stepwise backward elimination, only CDR-SB predicted differences in ratings with fewer differences evident in patients with higher CDR (more severe dementia) ($B = -0.076$, $p < 0.01$)

Discussion

There was only a modest level of agreement between proxy and self-reported PWD QOL ratings upholding our hypotheses and supporting past research: 44% of dyads agreed on QOL scores and a correlation between reports suggested a modest, but statistically significant association. It was more common that proxies reported lower PWD QOL than PWD QOL self-report (41% of dyads). While past research has found links between caregiver factors such as increased depressive symptoms and burden and lower caregiver proxy-rated reports of PWD QOL (Logsdon *et al.*, 2002; Karlawish *et al.*, 2001; Sands *et al.*, 2004; Shiffczyk *et al.*, 2010), the current study focused on variables related to the functioning of the PWD to explain these differences. QOL self-ratings were associated with medical co-morbidity while caregiver ratings of PWD QOL were primarily influenced by neuropsychiatric symptoms. These results support findings from smaller convenience samples reporting associations between lower QOL scores and neuropsychiatric symptoms (Hurt *et al.*, 2008), poor health (Esteban y Pena *et al.*, 2009), or lower education (Heyworth *et al.*, 2009). Given the population based design of this study the generalizability of such findings is broadened.

Not surprisingly, we found CDR-SB to be the major predictor of differences between proxy and self-reported ratings of QOL, whereas NPI scores did not significantly contribute to explaining differences between proxy and self-reported ratings of PWD QOL. This contrasts with the findings of others that the NPI symptoms burden and depression correlate with proxy QOL ratings for the PWD (Hurt *et al.*, 2008; Mougias *et al.*, 2010). These variables also have been reported as predictors of differences between self-and proxy ratings of QOL (Sands *et al.*, 2004). One plausible explanation is that this was a community-based sample, rather than a convenience sample, and that distressed carers were less likely to be oversampled in the current study.

There is a large body of literature investigating the meaning of QOL, domains of QOL assessment, and methodologies to measure QOL. Investigators have grappled with defining complex and abstract notions and providing operational definitions of QOL, especially in the context of dementia. Many assessments of PWD QOL exist which capture the multidimensional aspects of QOL (e.g. behaviors, social interactions, functioning; Lawton, 1991; activity and mood; Albert *et al.*, 1996). While the single-item QOL measure does not allow us to investigate each of these QOL components on a closer level, a single-item, global assessment is appropriate in epidemiologic settings and for the current analyses for several reasons. First, responding to questions that require contemplation, introspection and sustained attention becomes increasingly difficult for moderately to severely cognitively impaired individuals. In addition, queries that require higher order cognitive skills such as analysis or synthesis are also not feasible. Simplification of the language and number of items in a self-assessed QOL scale for individuals across varying degrees of impairment provides one solution to this problem. Second, the independent variables of interest in the study are related to behavior, functioning and other dementia-specific factors, which we chose to examine as predictors of QOL ratings in the current study.

The sample utilized in this study has both strengths and limitations. An advantage of the sample is that it is drawn from a population, and not a clinical setting. The majority of assessments of PWD QOL are derived from patient samples of PWD or other samples of individuals self-selecting, or proxy-selected into clinical settings. Clinical samples of persons with dementia and their caregivers may be more impaired, more stressed, or otherwise less generalizable to the population of persons with dementia and their caregivers. In the current study, however, we should also recognize that approximately 90% of Cache County residents are members of The Church of Jesus Christ of Latter Day Saints (Norton *et*

al., 2006). Having an ethnically and religiously homogeneous population minimizes potentially confounding variables such as cultural and lifestyle differences as well as the effects of smoking and alcohol consumption upon study outcomes. However results from this population may have restricted generalizability to other populations.

Finally, the use of a cross-sectional analysis did not allow for assessment of QOL ratings across time. The unique pattern of plateaus, declines in health, followed by regaining a lowered level of function that characterizes the course of dementia has a profound effect upon PWD and caregivers. Longitudinal assessment will be needed to improve our understanding of the dynamics of QOL ratings across time and their predictors.

Implications

The results from the current study have important clinical implications. The current standard of dementia care is generally palliative in nature, one aspect of which is to maximize QOL and limit suffering. The accurate measurement of the subjective experience of a person with dementia is difficult, particularly with increasing dementia severity. Gaining insight into patient characteristics that influence proxy reports of PWD QOL is important for both clinicians and proxy caregivers to improve the accuracy of ratings and consider this component of care independently of the symptoms of dementia. Comparing self and proxy PWD QOL early in the course of dementia may inform caregivers as to how the patient's dementia symptoms influence their ratings of PWD QOL, with the goal to provide more accurate assessments when the patient is no longer capable of self-report.

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Table 1

Crosstabs: Self- and Proxy-reported PWD QOL ratings

		Proxy PWD QOL					Total Original Responses	Total Collapsed Responses
		Excellent	Good	Fair	Poor	Very Bad		
Self-report PWD QOL	Excellent	8	24	6	2	1	41	41
	Good	11	50	23	7	2	93	93
	Fair	1	9	13	1	0	24	30
	Poor	0	0	2	2	1	5	
	Very Bad	0	0	1	0	0	1	
Total Original Responses		20	83	45	12	4	164	
Total Collapsed Responses		20	83	61				

Note: 44% of dyads (N = 73 out of 164; shaded boxes above) had congruent responses on their ratings of PWD QOL. Proxy reports were lower than Self-reports for 41% of dyads (N= 67 out of 164). Proxy reports were higher than Self-reports for 15% of dyads (N= 24 out of 164).

Table 2

Summary of Demographic Characteristics

Participants with Dementia	Total Sample (N = 246)
Caucasian N (%)	242 (98.4)
Females N (%)	151 (61.4)
Alzheimer's disease	181 (76.1%)
Age M (SD)	85.60 (5.77)
Education M (SD)	13.22 (2.86)
MMSE M (SD)	19.78 (7.25)
Dementia Duration M (SD)	3.97 (1.96)
Caregivers (proxies)	
Caucasian N (%)	243 (98.8)
Females N (%)	186 (75.6)
Age M (SD)	67.18 (14.25)
Education M (SD)	14.20 (2.42)
Relationship to PWD N (%)	
Spouse	99 (39.8)
Adult Offspring	124 (49.8)
Other	26 (10.4)
Frequency of Contact with PWD N (%)	
Daily, same residence	122 (49.0)
Daily, separate residence	26 (10.4)
Several times / week	48 (19.3)
Once / week	26 (10.6)
1–3 times / month or less	10 (4.0)
Not reported	17 (6.8)

Table 3

Predictors of Patient QOL Ratings

Predictor	Univariable			Multivariable		
	Odds ratio	95% CI	P-value	Odds ratio	95% CI	P-value
QOL ratings of excellent versus fair, poor or very bad						
Onset age	1.01	0.94 – 1.08	0.88	----	----	----
Gender	1.21	0.53 – 2.73	0.65	----	----	----
Education	1.10	0.96 – 1.28	0.18	----	----	----
GMHR-P	3.34	1.59 – 7.02	0.01*	3.71	1.56 – 8.79	<0.01*
CDR-SB	0.91	0.82 – 1.01	0.08	----	----	----
NPI	0.96	0.93 – 0.10	0.04*	0.97	0.93 – 1.02	0.23
DSRS	0.95	0.90 – 0.10	0.03*	1.00	0.94 – 1.07	0.97
MMSE	1.10	1.02 – 1.20	0.02*	1.09	0.98 – 1.20	0.11
QOL ratings of good versus fair, poor or very bad						
Onset age	0.98	0.93 – 1.04	0.29	----	----	----
Gender	1.26	0.63 – 2.53	0.51	----	----	----
Education	1.09	0.96 – 1.24	0.17	----	----	----
GMHR-P	2.12	1.14 – 3.93	0.02*	2.26	1.10 – 4.64	0.03*
CDR-SB	1.01	0.93 – 1.09	0.82	----	----	----
NPI	0.99	0.96 – 1.02	0.36	0.98	0.95 – 1.02	0.28
DSRS	1.00	0.97 – 1.04	0.86	1.03	0.97 – 1.09	0.36
MMSE	0.99	0.94 – 1.05	0.73	0.993	0.92 – 1.07	0.86

Note:

* indicates $p < 0.05$. Multivariable model includes all variables significant in univariable analyses.

Educ = Education; GMHR-P = General Medical Health Rating – Patient; CDR-SB = Clinical Dementia Rating – Sum of Boxes; NPI = Neuropsychiatric Inventory; DSRS = Dementia Severity Rating Scale; MMSE = Mini-mental State Exam.

Table 4

Predictors of Caregiver Ratings of Patient QOL

Predictor	Univariable			Multivariable		
	Odds ratio	95% CI	P-value	Odds ratio	95% CI	P-value
QOL ratings of excellent versus fair, poor or very bad						
Onset age	1.03	0.95 – 1.12	0.51	----	----	----
Gender	0.73	0.27 – 2.00	0.73	----	----	----
Education	1.32	1.10 – 1.58	<0.01 [*]	1.34	1.08 – 1.67	<0.01 [*]
GMHR-P	3.17	1.23 – 8.19	0.02 [*]	3.36	1.14 – 9.88	0.03 [*]
CDR-SB	0.72	0.57 – 0.91	<0.01 [*]	0.77	0.54 – 1.11	0.16
NPI	0.94	0.89 – 0.99	0.01	0.963	0.90 – 1.03	0.25
DSRS	0.89	0.83 – 0.96	<0.01 [*]	0.98	0.87 – 1.09	0.68
MMSE	1.18	1.03 – 1.35	0.02	1.01	0.85 – 1.19	0.96
QOL ratings of good versus fair, poor or very bad						
Onset age	1.01	0.95 – 1.06	0.85	----	----	----
Gender	0.75	0.39 – 1.44	0.40	----	----	----
Education	1.06	0.94 – 1.20	0.32	1.03	0.89 – 1.19	0.68
GMHR-P	1.56	0.87 – 2.85	0.13	1.36	0.68 – 2.72	0.38
CDR-SB	0.84	0.76 – 0.93	<0.01 [*]	1.00	0.83 – 1.20	0.99
NPI	0.94	0.91 – 0.97	<0.01 [*]	0.94	0.91 – 0.98	<0.01 [*]
DSRS	0.92	0.89 – 0.96	<0.01 [*]	0.98	0.91 – 1.05	0.56
MMSE	1.11	1.03 – 1.18	<0.01 [*]	1.06	0.96 – 1.16	0.24

Note:

* indicates p< 0.05. Multivariable model includes all variables significant in univariable analyses.

Educ = Education; GMHR-P = General Medical Health Rating – Patient; CDR-SB = Clinical Dementia Rating – Sum of Boxes; NPI = Neuropsychiatric Inventory; DSRS = Dementia Severity Rating Scale; MMSE = Mini-mental State Exam.

Table 5

Predictors of differences in Self- vs. Caregiver QOL Ratings of Patient

Predictor	Univariable			Multivariable		
	Beta	95% CI	P-value	Beta	95% CI	P-value
Onset age	0.02	-0.01 – 0.05	0.16	---	---	---
Gender	-0.37	-0.67 – -0.07	0.02 [*]	-0.26	-0.56 – 0.04	0.09
Education	0.03	-0.03 – 0.08	0.30	---	---	---
GMHR-P	-0.00	-0.28 – 0.27	0.98	---	---	---
CDR-SB	-0.09	-0.13 – -0.04	0.01 [*]	-0.08	-0.12 – -0.03	0.02 [*]
NPI	-0.01	-0.03 – -0.00	0.04 [*]	-0.07	-0.02 – 0.01	0.37 [†]
DSRS	-0.03	-0.05 – -0.01	0.02 [*]	0.02	-0.03 – 0.03	0.90 [†]
MMSE	0.03	-0.00 – -0.06	0.07	---	---	---

Note:

^{*} indicates $p < 0.05$. Multivariable model includes all variables significant in univariable analyses.[†] indicates the variables that were excluded in multiple stepwise regression with backward elimination.

Educ = Education; GMHR-P = General Medical Health Rating – Patient; CDR-SB = Clinical Dementia Rating – Sum of Boxes; NPI = Neuropsychiatric Inventory; DSRS = Dementia Severity Rating Scale; MMSE = Mini-mental State Exam.