

Cognitive decline in Alzheimer disease

Impact of spirituality, religiosity, and QOL

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ABSTRACT Objective: To assess effects of quality of life (QOL), spirituality, and religiosity on rate of progression of cognitive decline in Alzheimer disease (AD). **Methods:** In this longitudinal study, we recruited 70 patients with probable AD. The Mini-Mental State Examination was used to monitor the rate of cognitive decline. Religiosity and spirituality were measured using standardized scales that assess spirituality, religiosity, and organizational and private religious practices. We conducted a simultaneous multiple linear regression analysis for factors contributing to rate of cognitive decline. **Results:** After controlling for baseline level of cognition, age, sex, and education, a slower rate of cognitive decline was associated with higher levels of spirituality ($p < 0.05$) and private religious practices ($p < 0.005$). These variables accounted for 17% of the total variance [$F(11,58) = 2.24, p < 0.05$]. There was no correlation between rate of cognitive decline and QOL. **Conclusion:** Higher levels of spirituality and private religious practices, but not quality of life, are associated with slower progression of Alzheimer disease. **NEUROLOGY 2007;68:1509-1514**

Increased levels of quality of life (QOL) have a beneficial effect on health outcomes, morbidity, and mortality.¹⁻³ Similarly, high levels of spirituality and religiosity also are correlated with lower morbidity and mortality,^{7,8} lower cardiovascular-related mortality,⁹ enhanced QOL and well-being,^{5,6} and lower levels of depression and psychological stress.¹⁰⁻¹² Possible mechanisms by which spirituality/religiosity may affect health outcomes include a more favorable immune profile,^{15,16} lower rates of depression,^{17,18} higher compliance with treatment,¹⁹ quicker response to acute health crises,²¹⁻²³ less health-risking behaviors (e.g., smoking, alcoholism),^{5,6,20,24} healthier lifestyles (e.g., healthy diets),²⁴ enhancement of social ties and social well-being,²⁴ optimism and hope,^{13,14} stress reduction,²⁵⁻²⁷ enhanced cognitive stimulation, and lower rates of suicide.^{5,6}

Although QOL, spirituality, and religiosity have been associated with better outcomes in many disorders, including neurologic disease, their impact on rate of cognitive decline in Alzheimer disease (AD) calls for investigation. This longitudinal study was undertaken as an attempt to determine whether QOL, spirituality, and religiosity influence the rate of cognitive decline in AD.

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METHODS Subjects. Seventy subjects, aged 49 to 94 years, were recruited from the Behavioral Neurology Clinic at Baycrest during their regular follow-up visits. All subjects had Mini-Mental State Examination (MMSE) scores above 10 and met National Institute of Neurological and Communicative Disorders and Stroke–Alzheimer’s Disease and Related Disorders Association criteria for probable AD²⁸ or National Institute of Neurological Disorders and Stroke–Association Internationale pour la Recherche et l’Enseignement en Neurosciences criteria for AD with cerebrovascular disease.²⁹ At the time of recruitment, patients were reassessed for cognitive function and initially assessed for QOL, spirituality, and religiosity. Subsequently, cognitive function was prospectively assessed over the course of 1 year. The baseline cognitive assessment was taken from the initial evaluation when the patients were first seen and was extracted from the medical files. The mean retrospective follow-up time was 2.1 years, and the mean longitudinal follow-up time was 3.14 years.

Clinical evaluation. Each subject had a uniform structured evaluation, performed by a neurologist, that included a medical history, neurologic examination, and detailed cognitive testing at baseline. Blood tests included complete blood count, serum thyroid-stimulating hormone, serum vitamin B₁₂, and Venereal Disease Research Laboratories test. In addition, CT and SPECT scans were performed. Patients with vascular dementia or other non-AD dementia, major psychiatric disorders, major or unstable medical conditions, seizure disorder, Parkinson disease, substance abuse, major head trauma (with major parenchymal damage and long-term sequelae), or tumor were excluded.

Assessment of cognition. Initial cognitive evaluation was performed using the Behavioral Neurology Assessment³⁰ and MMSE.³¹ The annual rate of cognitive decline was derived from the difference between the initial and final MMSE scores.

Assessment of spirituality and religiosity. Religiosity and spirituality were measured using the Duke University Religion Index (DUREL)³² and the Overall Self-Ranking subscale from the NIH/Fetzer Brief Multidimensional Measure of Religiousness/Spirituality subscales.³³ The DUREL is a five-item measure designed to assess organizational and private religious and spiritual practices. The DUREL has three subscales: attendance (one item that asks about frequency of attending a religious meeting), private religious practices (one item that asks about frequency of spending time in private religious activities), and intrinsic religiosity (three items that ask about religious belief or experience).

The attendance item assesses frequency of attendance at formal public religious institutions. Most surveys that measure religiousness include a measure of attendance at religious services. Cross-sectional and longitudinal studies consistently find a significant association between religious attendance and physical health status indicators, disability and mortality.⁵

The Overall Self-Ranking subscale from the NIH/Fetzer Brief Multidimensional Measure of Religiousness/Spirituality is a two-item scale. Items are scored from 1 (low) to 4 (high). One item refers to level of religiosity, and the other refers to spirituality. The interviewer asks participants to what extent they assess themselves as being spiritual or religious.

Variations of the constituent items of both measures have appeared in validated scales or have been subsequently validated in secondary analyses. For example, items regarding private religious activities were confirmed in studies among older

adults³⁴ and across the life course.³⁵ Similar items also formed part of an internally consistent, reliable measure of private religiosity in four successive age cohorts within a multiracial national probability sample.³⁶

Assessment of quality of life. Quality of Life in AD scale. The health-related Quality of Life in Alzheimer’s Disease (QOL-AD) scale is a 13-item measure of QOL with a total score between 13 (poor QOL) and 52 (good QOL). Reliability for both patient and caregiver reports were good (alpha values ranged from 0.83 to 0.90).^{37,39} Validity of patient and caregiver reports across different cognitive levels was supported by correlation with measures of depression ($r = -0.41$ to -0.65), day-to-day functioning ($r = -0.10$ to -0.45), and pleasant events frequency ($r = 0.18$ to 0.51). Intraclass correlation between patient and caregiver reports was positive across all cognitive levels ($r = 0.14$ to 0.39). Thus, the QOL-AD seems to be reliable and valid for individuals with MMSE scores greater than 10. Assessment of QOL has been shown to be valid even in patients with severe AD.³⁸

Visual analog scale from the EuroQOL EQ5D instrument. The visual analog scale EQ5D instrument is a patient-based generic questionnaire for health assessment. This self-report measure is described as a “feeling thermometer.”³⁴ It consists of a vertical line marked with numbers from 1 to 100. Patients are asked to rate their perception of health on this scale. Although this scale is not limited to health-related aspects of QOL, it provides a general complementary picture of the patient’s QOL to the QOL-AD.

Data analysis. To address our study hypotheses, we conducted a multiple regression analysis to provide an estimate of the unique contribution of QOL, spirituality, and religiosity scores over and above other demographic and clinical variables in predicting the rate of cognitive decline in AD. Multicollinearity was assessed by inspecting the partial correlation of the independent variables with the rate of MMSE decline. Other colinearity diagnostics such as tolerance were examined. Finally, to characterize the associations between QOL, spirituality, and religiosity, partial correlations were computed. Statistical analyses were performed using SPSS statistical package for Windows version 12.0 (SPSS Inc., Chicago, IL, 2003).

RESULTS Table 1 shows demographic characteristics and key study variables. In the linear multiple regression, two variables emerged as major predictors of the annual MMSE decline rate: The first factor was spirituality self-rating scale ($r = -0.369$, $p = 0.014$; table 2). The second predictor in the regression was the private religious activities score (from the DUREL ($r = -0.481$, $p < 0.005$)). These predictors in the multiple regression model accounted for 16.5% of the variance of the annual decline in MMSE score.

Partial correlations indicated that a slower rate of cognitive decline was related to high levels of spirituality ($r = -0.315$) and private religious activities ($r = -0.374$). Moreover, despite the low tolerance and the high intercorrelation between religiosity, attendance, and intrinsic religiosity, the weak partial relationship between these variables and the annual MMSE decline rate indicates that

Table 1	Group characteristics*
Age, y	78.43 ± 8.64 (49-94)
Sex, female, %	69
Education, y	12.01 ± 3.43 (5-20)
Marital status, married, %	64.3
Mean follow-up time, y	3.14 ± 2.10 (0.83-10.83)
MMSE at baseline	23.66 ± 3.86 (13-30)
Annual decline in MMSE	1.26 ± 2.13 (-6.29-7.55)
QOL-AD scale	34.76 ± 4.89 (19.5-42.5)
EuroQOL Thermometer scale	69.45 ± 16.06 (20-100)
Religiosity self-ranking	2.43 ± 0.79 (1-4)
Spirituality self-ranking	2.44 ± 0.94 (1-4)
Attendance (DUREL)	3.17 ± 1.31 (1-6)
Private religious activities (DUREL)	2.78 ± 1.86 (1-6)
Intrinsic religiosity (DUREL)	8.89 ± 3.88 (3-15)

*Values are mean ± SD (range).

MMSE = Mini-Mental State Examination; QOL-AD = Quality of Life in Alzheimer's Disease; DUREL = Duke University Religion Index.

multicollinearity did not obscure possible relationships.

Finally, both QOL scales were correlated and high scores in the visual analog scale EQ5D were associated with high scores in the QOL-AD. However, QOL measures were not correlated with rate of cognitive decline (table 3).

DISCUSSION Higher levels of private religious activities and of spirituality predict slower cognitive decline in patients with AD. This relationship was demonstrated in the multiple regression analysis after controlling for age, sex, education, and cognitive level at baseline. These results are consistent with

studies that show the impact of spirituality/religiosity on other disease states.^{4,40-43} Several investigators have also found that increased participation in private religious activities was associated with health status such as longer survival,⁴³ better health behaviors,²⁰ and lower blood pressure.⁴⁴⁻⁴⁵

Although cross-sectional and longitudinal studies have consistently shown that attending religious services are correlated with physical health-status indicators, such as low rates of disability and mortality,^{5,50} attendance was not associated with rate of AD progression in the present study. This discrepancy may be explained by reduced religious attendance due to progressive difficulties in mobility in the frail elderly with dementia. Our subject group was elderly (mean age 78.43 ± 8.64 years). This aged, frail, and cognitively impaired group is likely to have greater difficulties in attending religious services, and thus spirituality/religiosity may be better expressed through private religious activities.⁴⁶⁻⁴⁹

The reason that self-rated religiosity, like attendance, was not correlated with rate of cognitive decline may be that subjects may self-rate levels of religiosity based on their attendance in organized religious activities. This may explain the finding that older AD patients' religiosity scores and attendance in religious meetings were lower than younger AD patients ($r = -0.26$, $p < 0.05$ and $r = -0.20$, $p < 0.10$ for religiosity and age and attendance and age correlation, respectively).

QOL domains did not correlate with rate of cognitive decline. This is in keeping with previous studies that show no decline of QOL with greater disease severity,³⁸ in particular when QOL is assessed using patients' self-reports,⁵¹ and may indi-

Table 2	Summary of multiple regression analysis with critical item variables and list variables used as predictors				
Variable	β	Partial correlation	Tolerance	t Value	p
Age	-0.072	-0.079	0.832	-0.601	0.550
Education	0.127	0.132	0.765	1.011	0.316
Sex	0.196	0.217	0.905	1.692	0.096
MMSE at baseline	0.203	0.207	0.762	1.615	0.112
QOL-AD scale	0.107	0.081	0.403	0.619	0.539
EuroQOL Thermometer	-0.097	-0.075	0.417	-0.571	0.570
Religiosity self-rate	0.144	0.106	0.383	0.810	0.421
Spirituality self-rate	-0.369	-0.315	0.569	-2.529	0.014
Attendance	0.081	0.069	0.505	0.524	0.602
Private religious activities	-0.481	-0.374	0.493	-3.073	0.003
Intrinsic religiosity	0.242	0.173	0.373	1.340	0.185

The partial correlation values denote the correlation between the predicting and predicted variables with all the other variables in the multiple regression analysis partialled out.

MMSE = Mini-Mental State Examination; QOL-AD = Quality of Life in Alzheimer's Disease.

Table 3 Zero-order (below diagonal) and partial (above diagonal) correlations between various measures in patients with Alzheimer disease

	Sex	Age	Educ	M bl	M rate	F/U	Relig	Spirit	Atten	Priv	Intrin	Ther	QOL-AD
Age	0.08												
Education	-0.17	-0.12											
MMSE at baseline	-0.17	-0.16	0.36*										
MMSE annual decline rate	0.10	-0.14	0.15	0.24 [‡]									
Mean follow-up time	0.10	0.32*	-0.01	-0.06	0.02								
Religiosity self-rate	0.14	-0.26*	-0.09	-0.11	-0.08	0.09		0.48*	0.60*	0.56*	0.67*	0.06	0.07
Spirituality self-rate	0.06	-0.11	0.10	0.11	-0.23 [‡]	0.10	0.49*		0.48*	0.31*	0.55*	0.04	0.23
Attendance	-0.004	-0.20	-0.16	-0.12	-0.15	-0.03	0.63*	0.46*		0.49*	0.47*	0.08	0
Private religious activities	0.15	-0.08	-0.12	-0.21	-0.35*	0.01	0.59*	0.36*	0.52*		0.64*	0.06	0.04
Intrinsic religiosity	0.15	-0.17	-0.16	-0.09	-0.10	0.04	0.70*	0.54*	0.51*	0.65*		0.15	0.23
EuroQOL Thermometer	-0.05	0.17	-0.02	0.03	0.01	0.07	0	0.01	-0.12	-0.09	0.10		0.76*
QOL-AD scale	-0.04	0	0.13	-0.03	0	0.03	0.06	0.22	-0.02	0.03	0.20	0.74*	

The variables controlled for in the partial correlations were sex, education, Mini-Mental State Examination (MMSE) score at baseline, MMSE rate of decline, and mean follow-up time.

* $p < 0.005$ (two-tailed).

[‡] $p < 0.01$ (two-tailed).

[‡] $p < 0.05$ (two-tailed).

Educ = Education; M bl = MMSE score at baseline; M rate = MMSE rate of decline; F/U = mean follow-up time; Relig = religiosity; Spirit = spirituality; Atten = attendance; Priv = private religious activities; Intrin = intrinsic religiosity; Ther = EuroQOL Thermometer; QOL-AD = Quality of Life in Alzheimer's Disease scale.

cate that QOL does not influence cognitive decline. Alternatively, measures used here to assess QOL may not have captured relevant factors related to cognitive decline in AD. Moreover, it is also possible that measures used to evaluate QOL do not tap into spirituality/religiosity aspects of QOL that influence cognitive decline. Future studies should include spirituality- and religiosity-related QOL measures when assessing the impact of QOL on clinical outcomes.

Spirituality, but not religiosity, was somewhat correlated with QOL ($r = 0.22$, $p < 0.09$). This could be due to effect size or the possibility that aspects of spirituality and religiosity may affect cognitive decline via mechanisms other than QOL. Alternatively, as claimed above, this may be because QOL measures did not include spirituality/religiosity characteristics.

Several aspects in the present study warrant comments that need to be taken into consideration for future studies. First, the sample size was relatively small. Additional studies should be conducted with a larger sample to replicate the observed effects and investigate potentially underpowered smaller effects. Second, there are several variables that we did not measure but that may have contributed to the observed relation between spirituality, religiosity, and cognitive decline. These include socioeconomic status, social support, compliance with medication,

levels of stress, coping styles, diet, depression, and health risk-taking behaviors such as smoking and heavy alcohol intake. Third, measures of spirituality and religiosity were recorded at only one point in time. Future studies should assess the consistency of these measures over time, and whether they reflect a life-long pattern or a recent change. Fourth, measures of QOL in AD that include aspects of spirituality and religiosity may help to determine whether QOL is related to cognitive decline on the one hand and to spirituality/religiosity variables on the other hand. Further investigations are needed to replicate the present findings and to better understand the meaning of the observed relationship between spirituality/religiosity and cognitive decline.

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