

Comparison of Patient and Caregiver Reports of Patient Activity Participation and Its Relationship to Mental Health in Patients With Alzheimer's Disease

Karen L. Siedlecki,¹ Oksana Tatarina,¹ Linda Sanders,¹ Marilyn Albert,² Deborah Blacker,³ Bruno Dubois,⁴ Jason Brandt,⁵ and Yaakov Stern¹

¹Cognitive Neuroscience Division, Taub Institute, Columbia University, New York.

²Department of Neurology, Johns Hopkins University, Baltimore, Maryland.

³Department of Psychiatry, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts.

⁴Department of Neurology, Hôpital de la Salpêtrière, Paris, France.

⁵Psychiatry and Behavioral Sciences, Johns Hopkins University, Baltimore, Maryland.

The relationship between engagement in pleasant activities as rated by the patient and as rated by the caregiver from the patient's perspective was examined using structural equation modeling in a sample of patients ($N=277$) diagnosed with mild to moderate Alzheimer's disease. The two activity participation ratings were only moderately related to one another. Furthermore, depression was the only significant predictor of the patient-rated activity participation, whereas severity of depression, degree of personality change, level of dependence, and cognition were all significant predictors of caregiver-rated activity participation. These findings suggest that caregivers consider a wider range of variables when evaluating the patient's engagement in activities than does the patient. Predictors of patient-rated activity participation did not differ as a function of age or cognition.

Key Words: Activities—Alzheimer's disease—Invariance analyses—Structural equation modeling.

IMPROVING patient quality of life (QoL) has been identified as an important objective in treating dementia (Logsdon, McCurry, & Teri, 2007). Patients with Alzheimer's disease (AD) consistently report that mood, participation in pleasant activities, and the ability to perform activities of daily living (ADLs) are important factors that influence their QoL. Patient caregivers also report that mood and engagement in pleasant activities are important components to the patient's QoL, in addition to physical and cognitive functioning (Logsdon et al.).

In normal aging, a positive relationship between activity level and well-being has been consistently demonstrated across many studies (e.g., Beck & Page, 1988; Herzog, Franks, Markus, & Holmberg, 1998), and Menec (2003) reported that engaging in different social and productive activities was related to a reduction in functional decline and mortality over a 6-year span. Anecdotally, engagement in pleasant activities is linked to increased self-efficacy, reduction in depression symptoms, and improved relationships with family members of patients diagnosed with dementia (Logsdon et al., 2007). Teri, Logsdon, Uomoto, and McCurry (1997) empirically tested these relationships by conducting randomized clinical trials with depressed individuals diagnosed with dementia. Seventy-two dyads consisting of caregiver and care recipient (i.e., the patient diagnosed with dementia) were randomly assigned to a behavioral treatment (BT) group or control group. The intervention included teaching the caregivers to identify and increase

pleasant and meaningful activities for the patient and to prevent or reduce behaviors in the patient associated with depression. After 9 weeks, members of the BT group demonstrated significant improvements in their depressive symptoms, as compared with those in the control group, and this improvement was maintained for 6 months. An additional randomized control study of 95 care recipients (this time of patients diagnosed with dementia with behavioral disturbances) and caregivers to a similar BT group or control group also showed improvements after eight weekly visits and four monthly phone calls from a social worker or counselor. Specifically, the caregivers' reactions to the patient behavioral disturbances were significantly improved, and the QoL of the caregivers in the BT group was significantly higher than in the control group (Teri, McCurry, Logsdon, & Gibbons, 2005).

These findings provide evidence that engagement in pleasant activities may improve the QoL of both the patient and the caregiver. In fact, some researchers have used engagement in activities as an indicator of health-related QoL (Albert, Castillo-Castaneda, Sano, & Jacobs, 1996; Albert et al., 1999). Furthermore, research has indicated that greater participation in leisure activities is associated with a reduced relative risk of developing dementia in a population-based longitudinal study (Scarmeas, Levy, Tang, Manly, & Stern, 2001).

Although it is currently unclear whether interventions in the early stages of dementia consisting of engagement

in activities associated with a decreased risk of developing AD would be an effective treatment, it may be that participation in such activities may reduce the rate of cognitive decline in patients with dementia. As such, research regarding engagement in rewarding and meaningful activities is an important topic and may help elucidate the ways in which to improve dementia-related outcomes, such as QoL, well-being, or cognitive decline. Therefore, the purpose of this paper was to gain a better understanding of the variables that predict involvement in pleasant activities in a sample of patients diagnosed with mild to moderate AD.

Conducting research with participants with cognitive impairment introduces a unique set of considerations. Because patients with cognitive impairment, such as those diagnosed with AD, may lack the necessary insight, self-awareness, or metacognitive judgments to evaluate their own life circumstances (Brandt, 2007), caregivers are often asked to complete evaluations from the patient's perspective. However, caregiver ratings may be biased and it is unclear whether a proxy can truly and accurately evaluate a patient's experience (Brandt). Therefore, another purpose of this study includes examining the differences in the patient and caregiver reports of patient activity participation in a sample of patients with mild to moderate AD.

The patients with AD and the caregivers in our study completed the Patient Activity Scale-AD (PAD-AD; Albert et al., 1996, 1999), which includes a list of 15 activities and asks whether the patient has had the opportunity to engage in each respective activity, the frequency of engaging in the activity, and whether the patient enjoyed the activity. Because both the patient and the caregiver completed the activity scale from the patient's perspective, we were able to examine how closely the ratings correlated with one another across the two groups.

Personality change as measured by a subscale of the Blessed Functional Activity Scale (Blessed, Tomlinson, & Roth, 1968), *depression* as measured by the Brief Symptom Inventory (Derogatis & Melisaratos, 1983), degree of *dependence* as measured by the Dependence Scale (Stern et al., 1994), and *cognition* as measured by the Modified Mini-Mental State (mMMS) Examination (Stern, Sano, Paulsen, & Mayeux, 1987) were included as predictors in the current study. AD-associated changes in personality and behavior are often considered by family members to be one of the more disruptive and important sequelae of dementia. Although we are unaware of any previous studies that have examined the relationship between personality change and engagement in activities, we hypothesized that higher scores on the personality change measure would be associated with decreased scores on the PAD-AD. The focus of nonpharmaceutical interventions in dementia, such as occupational therapy, is often to improve ADLs in order to decrease patient dependence on caregivers and to promote participation in pleasant or social activities

(Graff et al., 2006). Because the ability to participate in pleasant activities is closely linked to functional capabilities measured by the dependence scale, it was hypothesized that increased dependence would be associated with a decrease in the PAD-AD. Prior research has indicated that both patient depression and cognitive functioning are associated with decreased frequency of engaging in pleasant activities, as measured by the Pleasant Activities Schedule-AD (Logsdon & Teri, 1997). To examine the unique predictive value of each of the variables described previously, we examined a structural equation model in which the latent constructs of personality change, depression, dependence, and cognition predicted constructs representing patient-rated and caregiver-rated patient activities (see Figure 1).

Additional goals of this study include examining whether differences in predictors of the PAD-AD are related to patient age or cognition. Specifically, do the predictors of PAD-AD differ in patients with AD as a function of age, and are the predictors of the PAD-AD related to level of cognitive impairment? These multigroup invariance analyses are exploratory in nature although there is some evidence that the predictors of a related measure (i.e., QoL) may vary across dementia severity (Logsdon, Gibbons, McCurry, & Teri, 2002).

In summary, the first goal is to compare patient-rated and caregiver-rated reports on the PAD-AD. The second goal is to identify the predictors of the PAD-AD and to examine whether there are differences in predictors based on whether the patient or caregiver provides the assessment. The third goal is to determine whether there are differences in the predictors of the PAD-AD related to patient age or cognition.

METHODS

Participants

Participants were 277 patients diagnosed with mild to moderate AD, recruited from Columbia University ($n=115$), Johns Hopkins University ($n=63$), Massachusetts General Hospital ($n=63$), and the Hôpital de la Salpêtrière in Paris ($n=36$). Participants were members of the Predictors study second cohort, the details of which have been published elsewhere (Richards et al., 1993; Stern et al., 1993). Participants were recruited from memory disorders clinics, neurology practices, and clinical trials and were evaluated both by physicians who conducted a medical examination and during home visits from trained research assistants. To be enrolled in the study, participants were required to meet National Institute of Neurological and Communicative Disorders and Stroke diagnostic criteria for probable AD. They also had to demonstrate relatively mild cognitive impairment consistent with early AD, as defined by a score of >30 on the mMMS (Stern et al., 1987).

Inspection of the Table 1 shows that the mean age of the sample was about 76 years, and participants had the equivalent of approximately 2 years of college. The mean mMMS

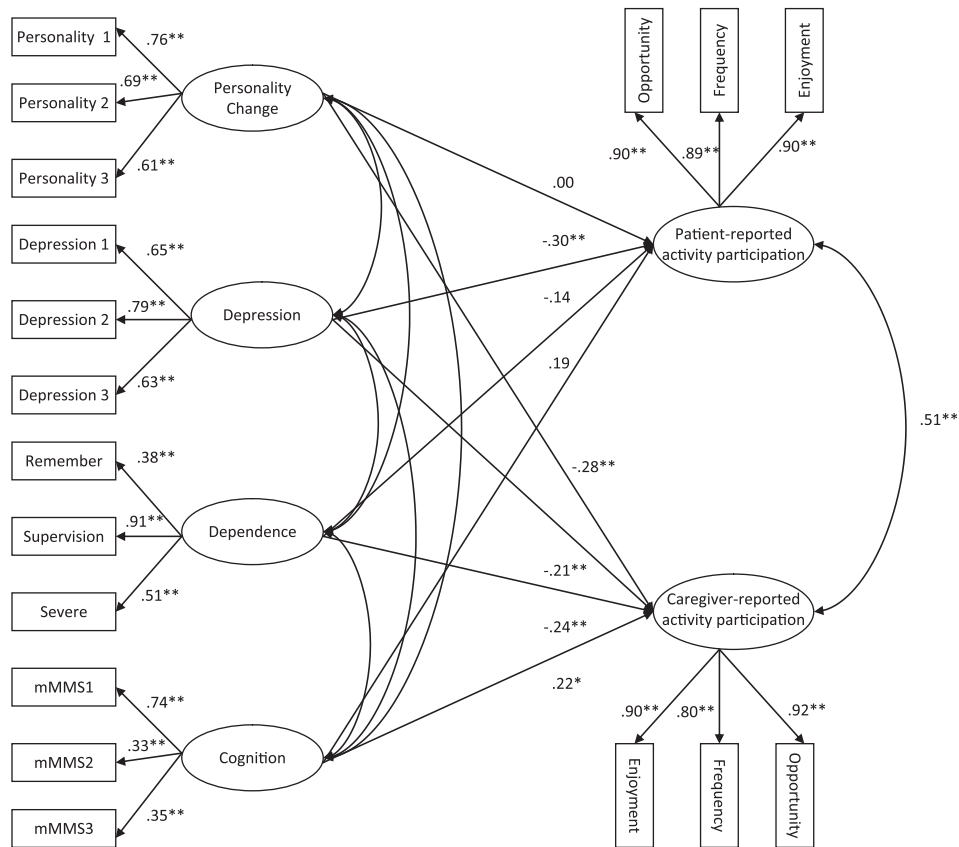


Figure 1. Six-factor model with both patient-rated activity participation and caregiver-rated activity participation constructs included. * $p < .05$. ** $p < .01$.

score of the sample of 41.60 is approximately equivalent to a score of 23 on the standard Mini-Mental State Examination (MMSE).

Caregiver age ranged from 31 to 89 years ($M = 61.24$, $SD = 13.69$). Most of the caregivers were the spouse ($n = 114$, 41.2%) or the child of the patient ($n = 83$, 30.0%). Six of the caregivers were a sibling (2.2%), 12 were classified as “other” (4.3%), and the relationship to the patient for 62 (22.4%) of the caregivers was unidentified.

Measures

Patient Activity Scale-Alzheimer's disease.—The PAD-AD, which is a modified version of the Pleasant Events Schedule-AD (Teri & Logsdon, 1991), was completed by both the patient and the caregiver (who completed the questionnaire from the patient's perspective). The PAD-AD consists of questions regarding 15 activities, 5 conducted outside the home (going outside; going to the

Table 1. Demographic Characteristics of the Participants Across Site Location

	Site Location				
	Columbia U	JHU	MGH	Paris	Total
<i>N</i>	115	63	63	36	277
Age (years)	74.83 (7.94)	76.00 (7.27)	78.70 (8.09)	73.44 (6.60)	75.79 (7.82)
Education (years)	15.12 (3.55)	13.73 (3.00)	13.84 (2.52)	12.31 (4.12)	14.15 (3.42)
% Male	47.8	39.7	41.3	38.9	43.3
mMMS	42.82 (5.81)	37.95 (5.14)	40.95 (6.68)	45.22 (5.18)	41.60 (6.23)
Ethnicity (%)					
White	106 (92.2)	57 (90.5)	63 (100)	35 (97.2)	261 (94.2)
Black	6 (5.2)	6 (9.5)	0	0	12 (4.3)
Other	2 (1.7)	0	0	0	2 (0.7)
Unknown	1 (0.9)	0	0	1 (2.8)	2 (0.7)

Note: Values are means (and SDs) or frequencies (and percents). JHU = Johns Hopkins University; MGH = Massachusetts General Hospital; Paris location is the Hôpital de la Salpêtrière. mMMS = Modified Mini-Mental State.

movies or other forms of entertainment; going to church, synagogue, or other religious events; going shopping; and going for a ride in the car), and 10 typically conducted at home (contact with a pet, getting together with family, talking to family or friends on the telephone, reading or being read to, listening to the radio or watching the television, exercising, playing games or puzzles, doing handicrafts, tending to plants or a garden, and completing an unspecified task considered difficult). For each activity, the rater is first asked whether the person with AD had the opportunity to participate in that activity during the past 2 weeks (yes/no). If "yes," they report how frequently the activity was performed (none/few/often) and if the activity was enjoyed (yes/no). Three scores were calculated; one each for opportunity, frequency, and enjoyment, which reflected the sum of each subscale.

Predictors of Patient Activities

Change in personality.—The Blessed et al. (1968) Functional Activity Scale is composed of a number of subscales, one of which assesses personality changes in the patient, as rated by the caregiver. The caregiver answers 11 yes/no questions such as "Is he/she more stubborn than before or less able to adapt to changes?" and "Has he/she stopped doing things (hobbies) that he/she used to like to do?"

Depression.—Depression was assessed by the depression scale of the Brief Symptom Inventory (Derogatis & Melisaratos, 1983) in which the patient is asked how often (on a 5-point Likert scale) he or she was bothered in the last week by feeling lonely, feeling blue, feeling no interest in things, feeling hopeless about the future, feelings of worthlessness, feelings being hurt, and thoughts of ending their life.

Dependence.—The Dependence Scale (Stern et al., 1994), completed in this study by the caregiver, consists of 13 items designed to rate the patient's need for care and includes items associated with mild impairment (e.g., Does the patient need reminders or advice to manage chores, do shopping, cooking, play games, or handle money?), moderate impairment (e.g., Does the patient need to be escorted when outside?), and severe impairment (e.g., Does the patient have to be fed?).

Neuropsychological assessment.—Cognitive functioning was assessed with the mMMS that includes all the items of the MMSE (Folstein, Folstein, & McHugh, 1975) and the Digit Span subtest of the Wechsler Adult Intelligence Scale-Revised. The mMMS also included additional items designed to assess attention/calculation, general knowledge, language, and construction (i.e., the copying of three different designs). The maximum score is 57, and the reliability and validity of which have been reported previously (Stern et al., 1987).

Modeling Technique

Structural equation modeling (SEM) was used to examine the relationship between patient-reported and caregiver-reported patient activity participation (measured by the PAD-AD) as well as to examine predictors of patient-reported activity participation. Multigroup invariance analyses were conducted to examine whether predictors remained the same across age group and across mMMS group. At the measurement level, we examined configural and metric invariance, and at the structural level, we examined the invariance of the second-order factor loadings and the interfactor correlations. *Configural invariance* (Horn, McArdle, & Mason, 1983) is established if the structure of the model is the same across the groups of interest, and therefore, only the structure of the model is constrained to be the same across the groups. Specifically, each corresponding latent construct (factor) is associated with the same corresponding set of observed variables in each group. Configural invariance is evaluated by examining the fit of the multigroup model. Several goodness-of-fit statistics were evaluated including the chi-square (χ^2), critical ratio (χ^2/df), and root mean square error of approximation (RMSEA), for which smaller values indicate better fit. Bentler's comparative fit index (CFI) was also examined; for this statistic, values closer to 1.0 indicate a better fit (Hu & Bentler, 1999). *Metric invariance* (Horn & McArdle, 1992) is established if the magnitudes of the lower-order relations between the observed variables and the latent variables (i.e., the factor loadings) are approximately equivalent. This is ascertained by constraining the values of the corresponding unstandardized factor loadings to be the same across the groups. If the fit of the metric invariance model is not significantly worse than the fit of the baseline, configural invariance model (as determined by the change in χ^2 by change in df), it can be argued that the model demonstrates metric invariance. Separate from measurement invariance is *structural invariance*, which refers to the relations among the latent variables. In this paper, structural relations refer to the interfactor covariances among the predictor variables and the higher-order path coefficients from the latent predictor variables (i.e., personality change, depression, dependence, and cognition) to the activity participation latent factor. If these higher-order relations are constrained (in addition to the lower-order factor loading assessed in the metric invariance model) and the fit is not significantly worse then it may be argued that the model demonstrates invariance at the structural level.

Amos 5.0 (Arbuckle, 2003) was used for all SEM analyses. Full-information maximum likelihood estimation was used to deal with missing data (less than 5% of the data were missing).

RESULTS

We first examined whether the construct of patient-rated activity participation exhibited configural and metric invariance

Table 2. Paired Sample *t* Test Results for Each PAD-AD Variable

PAD-AD Variable	Patient-Rated <i>M</i> (<i>SD</i>)	Caregiver-Rated <i>M</i> (<i>SD</i>)
Sum**	37.77 (8.34)	34.77 (8.41)
Frequency**	16.38 (4.23)	15.16 (4.15)
Opportunity**	11.14 (2.32)	10.44 (2.33)
Enjoyment**	10.25 (2.34)	9.17 (2.62)

Notes: PAD-AD = Patient Activity Scale-Alzheimer's disease.

***p* < .01.

across the four data collection sites (i.e., CU, JHU, MGH, and Paris). As compared with the unconstrained baseline model, the change in χ^2 per change in *df* of the model in which the factor loadings were constrained to be equal across the four samples was not significant ($\Delta\chi^2=13.32$, $\Delta df=9$, $p>.05$). This implies that the patient-rated activity participation factor is measuring the same construct to the same degree across the different sites, and therefore, it is acceptable to combine the four samples into one.

To examine the relationship between the patient- and caregiver-reported PAD-AD, a two-factor model was examined in which each activity participation latent factor was represented by the three observed variables of opportunity, frequency, and enjoyment. The two latent activity participation constructs were correlated .58 ($p < .01$) and the two-factor model fit reasonably well ($\chi^2=49.86$, $df=8$; CFI=0.97; RMSEA=0.138). The relatively high RMSEA value is likely due to the lower complexity of the model.

A paired sample *t* test indicated that the mean caregiver-rated PAD-AD score ($M=34.77$, $SD=8.41$) was significantly lower than the mean patient-rated PAD-AD score ($M=37.77$, $SD=8.33$; $t=6.00$, $p<.01$). Further, the mean caregiver-rated score for each of the summed subscales (frequency, opportunity, and enjoyment) was lower than the mean patient-rated score (see Table 2). It is important to note that the values presented in Table 2 are for the observed summed scores.

To examine whether the discrepancy between the patient and caregiver ratings is due to the patients' inability to accurately recall participating in the activities, we examined whether the correlation between the two constructs was higher for those with higher mMMS scores, who are presumably more accurate in completing the questionnaire. The sample was divided into a moderate mMMS group (30–38, $n=97$), a mild to moderate mMMS group (39–45, $n=97$), and a mild mMMS group (46–55, $n=83$). The correlation between the two activity participation constructs was .50 ($p<.01$) for the moderate mMMS group, .75 ($p<.01$) for the mild to moderate mMMS group, and .54 ($p<.01$) for the mild mMMS group. In a multigroup invariance model in which the correlation (and the factor loadings) was constrained to be equal across the three groups, the model did not fit significantly worse than a model in which the correlation was free to vary across the groups ($\Delta\chi^2=13.05$, $\Delta df=10$). This implies that the correlation estimates across the groups are not significantly different from

one another. However, inspection of the 95% confidence intervals indicates that the correlations of the moderate ($r=.50$, .36–.63) and the mild to moderate ($r=.75$, .67–.84) mMMS groups did not overlap, indicating that the correlation estimates were significantly different between those two groups specifically. The mild mMMS group correlation estimate ($r=.54$) was not significantly different from the correlation estimate in either the mild or the mild to moderate mMMS group. However, the 95% confidence intervals around the correlation estimates are fairly large, and it is possible that power is too low to detect all the differences.

Predictors of Activity Participation

The correlations among the activity participation measures and the predictor variables, as well as the reliabilities, are presented in Table 3. The patient-rated PAD-AD score and caregiver-rated PAD-AD score were both significantly related to personality change, depression, dependence, mMMS, and age at the univariate level. To further explore these relationships at the multivariate level using SEM, a six-factor model was examined in which the constructs of personality change, depression, dependence, and cognition predicted patient-rated and caregiver-rated activity participation (see Figure 1). The dimensionality of the data for the personality change and cognition scales was reduced through item parceling. A parcel, a sum of items from a scale, is an observed variable that is used as an indicator of the latent construct. For the dependence and depression scales, exploratory factor analysis (EFA) was used to determine the subscales in which the variables that loaded highest on each respective factor were summed to create an observed variable that was used as an indicator of the latent construct. Item parceling (in which parcels were created to have similar psychometric properties) was used to reduce the dimensionality of the data for the personality change and cognition variables instead of EFA because there was no clear factor structure; a number of variables had split loadings (personality change) or one factor accounted for most of the variance (cognition).

Three parcels emerged in the EFA of the Dependence Scale that represented the different levels of dependence. The *remember* variable was the sum of three items pertaining to reminder items representing mild dependence. The *supervision* variable was the sum of five items representing questions that corresponded to moderate dependence. The *severe* dependence variable was the sum of five questions pertaining to severe dependence.

The EFA of the depression scale indicated that three parcels were appropriate to represent the dimensionality of the depression subscale. The first variable (Depression 1) was the sum of two items (feeling lonely and feeling blue), the second variable (Depression 2) was the sum of three items (feeling no interest, feelings of worthlessness, and feelings being easily hurt), and the third variable (Depression 3) was

Table 3. Correlation Matrix of the Observed Variables

Variable	1	2	3	4	5	6	7
1. Patient-rated PAD-AD	(0.84)						
2. Caregiver-rated PAD-AD	0.56**	(0.84)					
3. Personality change total score	-0.13*	-0.34**	(0.74)				
4. Depression total score	-0.25**	-0.22**	0.14*	(0.78)			
5. Dependence total score	-0.22**	-0.38**	0.38**	0.11	(0.73)		
6. Total mMMS score	0.17**	0.24**	-0.06	0.00	-0.32**	(0.73)	
7. Age	-0.22**	-0.14*	-0.04	0.06	0.17**	-0.12*	—

Notes: mMMS = Modified Mini-Mental State; PAD-AD = Patient Activity Scale-Alzheimer's disease. Reliability estimates (assessed at the item level with Cronbach's alpha for all measures) are reported in parentheses.

* $p < .05$; ** $p < .01$.

the sum of two variables (feeling hopeless and thoughts of ending life).

The six-factor model fit the data adequately ($\chi^2=254.85$, $df=121$; CFI=0.90; RMSEA=0.063). All the lower-order factor loadings were significantly different from zero for each of the constructs, indicating that the constructs exhibited evidence of convergent validity (see Figure 1). The correlations among the constructs were in the low to moderate range, thereby suggesting that the constructs also exhibited discriminant validity. The only significant predictor of patient-rated activity participation was the depression construct, whereas personality change, depression, dependence, and cognition were all significant predictors of caregiver-reported activity participation.

Differences in Predictors of Patient-Rated Activity Participation

A five-factor model, in which patient-rated activity participation was the only dependent variable included in the model, was examined to evaluate potential differences in predictors of activity participation across age and mMMS group. This model is essentially the model presented in Figure 1 without the caregiver-rated activity participation construct. To examine age-related differences, two groups were created by dividing the sample by mean age into a young-old group (ages 49–76 years, $M=70.31$, $n=147$) and an old-old group (ages 77–95 years, $M=82.00$, $n=130$), and invariance of the five-factor model across age group was examined. The means for the young-old and old-old groups for each of the four scales are presented in the top half of Table 4. Mean dependence scores were the only variable significantly different between the two age groups.

Results of the invariance analyses (presented in the top half of Table 5) indicate that the configural invariance model fit the data well. Constraining the lower-order factor loadings to be the same across the two age groups (i.e., Model 2, metric invariance), as well as constraining the higher-order factor loadings and the interfactor covariances (i.e., Model 3, invariance at the structural level), did not cause the model to fit significantly worse than the configural model. How-

ever, in the young-old group, only the depression construct ($-.33$, $p < .01$) was a significant predictor of the activity participation construct, whereas in the old-old group, both depression ($-.29$, $p < .05$) and cognition ($.32$, $p < .05$) were significant predictors. Therefore, although there is a difference in significant predictors across age group, the difference in the magnitude of the path coefficients (.15 in the young-old and .32 in the old-old) was not significant.

These same analyses were conducted across mMMS groups. A low mMMS group (score range 30–41, $n=137$) and a high mMMS group (score range 42–55, $n=140$) were created. The means for the low mMMS and high mMMS groups for the four scales are presented in the bottom half of Table 4. As expected, there was a significant difference in mMMS score across the two groups. In addition, the low mMMS group had significantly greater scores on the dependence scale than did the high mMMS group.

Because scores on the mMMS score were used to divide the sample, the cognition construct was no longer included in the model. The baseline configural model fit the data well and neither constraining the lower-order factor loadings (Model 2) nor the higher-order factor loadings and interfactor covariances (Model 3) resulted in a significantly worse fit than the configural invariance model (see bottom half of Table 5). Inspection of the path coefficients indicated that the depression construct was a significant predictor of activity participation for the low mMMS group ($-.32$, $p < .01$) and for the high mMMS group ($-.29$, $p < .01$). In addition,

Table 4. *M* and *SDs* of Scales for Age and mMMS Groups

Scale	<i>M</i> (<i>SD</i>)	
	Young-old	Old-old
Personality change	4.18 (2.69)	3.95 (2.47)
Depression	9.79 (3.76)	9.98 (3.64)
Dependence**	4.80 (2.30)	5.72 (2.51)
mMMS	42.05 (6.17)	41.09 (6.27)
	Low mMMS	High mMMS
Personality change	4.23 (2.80)	3.92 (2.35)
Depression	9.72 (3.76)	10.03 (3.65)
Dependence**	5.87 (2.56)	4.59 (2.15)
mMMS**	36.36 (3.25)	46.72 (3.63)

Notes: mMMS = Modified Mini-Mental State.

** $p < .01$.

Table 5. Goodness-of-Fit Statistics for the Invariance Analyses of the Five-Factor Model

Model	χ^2	<i>df</i>	χ^2/df	CFI	RMSEA	$\Delta\chi^2$	Δdf	<i>p</i>
Young-old and old-old age groups								
Model 1: Baseline (configural) invariance	238.12	163	1.46	0.94	0.041			
Model 2: Invariant lower-order factor loadings	251.36	173	1.45	0.93	0.041	13.24	10	>.05
Model 3: Model 2 and invariant interfactor covariances and higher-order path coefficients	258.42	183	1.41	0.93	0.039	20.30	20	>.05
Low and high mMMS groups								
Model 1: Baseline (configural) invariance	166.87	100	1.67	0.94	0.049			
Model 2: Invariant lower-order factor loadings	174.45	108	1.62	0.94	0.047	7.58	8	>.05
Model 3: Model 2 and invariant interfactor covariances and higher-order path coefficients	185.78	114	1.63	0.94	0.048	18.91	14	>.05

Note: mMMS = Modified Mini-Mental State; CFI = comparative fit index; and RMSEA = root mean square error of approximation.

the dependence construct was a significant predictor of activity participation in the low mMMS group ($-.22, p < .05$) but not in the high mMMS group ($-.12$, nonsignificant). Although the dependence construct was a significant predictor in the low group but not in the high group, the path coefficients ($-.22$ and $-.12$) were not significantly different from one another.

DISCUSSION

Previous research has indicated that proxies or caregivers typically rate measures of QoL of patients lower than do patients themselves (Logsdon, Gibbons, McCurry, & Teri, 1999), and we also found that the caregiver-rated PAD-AD scores were significantly lower than the patient-rated PAD-AD scores. It is possible that the discrepancy is due to impaired ability among those with AD to accurately remember past events. However, the participants in this study were diagnosed with early AD, and, therefore, their deficits were mild to moderate. Furthermore, research has indicated that individuals diagnosed with mild to moderate dementia have the capacity to express preferences and are able to respond consistently to questions regarding their preferences (Feinberg & Whitlatch, 2001). Although our finding of only a moderate correlation ($r = .58, p < .01$) between the patient-rated and caregiver-rated activity participation was somewhat surprising in light of the fact that the PAD-AD presumably measures behaviors that are observable and objective, it is consistent with previous studies examining more subjective measures, such as QoL, that have found that proxy- or caregiver-rated QoL typically correlated weakly (Logsdon et al., 2002) to moderately (Sainfort, Becker, & Diamond, 1996) with patient-rated QoL.

To examine whether dementia severity affected the correlation between the patient-rated and caregiver-rated PAD-AD scores, analyses were conducted across mMMS groups. Surprisingly, there was not a linear relationship between the correlation magnitude and mMMS score. The correlation between the two activity participation constructs was higher for the mild to moderate mMMS group ($r = .75$) as compared with the moderate group ($r = .50$) and the mild

group ($r = .54$). One possible interpretation of these findings concerns the amount of time the caregiver spends with the patient. It may be that the individuals in the mild mMMS group are so high functioning that the caregiver is unaware as to how the patient spends his or her time, thereby reducing the correlation. The larger correlation in the mild to moderate mMMS group may reflect the increased time the caregiver spends with the patient who is relatively more impaired but still has fairly accurate memory recollections. That is, individuals in the mild to moderate mMMS group may spend more time with their caregivers (as compared with individuals in the mild mMMS group), and yet, they may have *relatively* intact memory. These two factors (time spent together and accuracy) would likely increase the correlation between the activity assessments for the patient and the caregiver. Finally, the discrepancy between the caregiver ratings and the patient ratings in the moderate mMMS may be due to faultier memory of the individuals in the moderate mMMS group.

Examination of the correlations among all the observed measures, presented in Table 3, indicated that the zero-order correlations among the PAD-AD measures and the predictors were all significant. However, when examined in the context of the six-factor model (presented in Figure 1), only depression was a significant predictor of patient-rated activity participation, and all four constructs were significant predictors of caregiver-rated activity participation. Therefore, although all the variables were significant predictors of patient-rated activity participation when considered independently (i.e., zero-order correlations), when examined simultaneously, only depression made a unique contribution to explaining patient-rated activity participation.

Engagement in meaningful activities is associated with increased QoL. The results of the current study indicate that depression was the one consistent predictor of activity participation, regardless of rater, and also when the sample was divided by age or mMMS score. This is consistent with findings reported by Logsdon and Teri (1997) who found that depression predicted frequency of engagement in pleasant activities. It is important to note that because these analyses are cross-sectional in nature, the causality of the

relationship between activity participation and the predictors is not known. It is possible, for instance, that a decrease in activity participation predicts an increase in depression and not vice versa.

In summary, the caregivers rated patient activity participation significantly lower than the patients rated their own activity participation, and the patient-rated and caregiver-rated PAD-AD scores correlated moderately with one another. There was no clear relationship between the size of the correlation and dementia severity. When the constructs of personality change, depression, dependence, and cognition were included in a model predicting patient-rated and caregiver-rated patient activity participation, depression was the only significant predictor of patient-rated activity participation. All four of the constructs were significant predictors of caregiver-rated patient activity participation, which likely explains the lower than expected correlation between the two constructs. Analyses examining whether the predictors of patient-rated activity participation differed as a function of age or mMMS group indicated that there were no significant age-related or dementia-related differences in the predictors of patient-rated activity participation.

These findings add to the literature suggesting that proxy ratings are not equivalent to patient ratings. Whereas depression is a consistent predictor of patient-rated activity participation, caregivers appear to consider other variables in their evaluation. Reconciling these discrepancies is an important challenge for researchers and clinicians in our field. This is especially true when such measures are used as outcome measures in dementia intervention trials, for example. Failure to assess patient-rated activity participation may obscure positive effects of the intervention. The measure used in this study was a self-report and proxy-report measure, and it is unknown which assessment is more accurate. Coupled with findings that suggest individuals with mild to moderate cognitive impairment are able to consistently state their preferences and choices (e.g., Feinberg & Whitlatch, 2001) and can rate their own QoL (Selai, Trimble, Rossor, & Harvey, 2001), our results indicate that it is may be important to include both the patient's own assessment of activity participation and the caregiver's assessment with mild to moderately impaired patients with AD. Both patient and caregiver reports of patient activity participation may provide valuable yet different insights into the relationship between engagement in pleasant activities and variables of interest.

FUNDING

This study was supported by National Institute of Health federal grants AG07370 and RR00645. KLS is supported as a trainee by a grant (T32MH020004-09) from the NIMH.

ACKNOWLEDGMENTS

We would like to thank our anonymous reviewers for their thoughtful suggestions.

CORRESPONDENCE

Address correspondence to Karen L. Siedlecki, PhD, Cognitive Neuroscience Division, Taub Institute, Columbia University, 630 West 168th Street, New York, NY 10032, USA. Email: ks2513@columbia.edu.

REFERENCES

- Albert, S. M., Castillo-Casteneda, C., Jacobs, D. M., Sano, M., Bell, K., Merchant, C., Small, S., & Stern, Y. (1999). Proxy-reported quality of life in Alzheimer's patients: Comparison of clinical and population-based samples. *Journal of Mental Health and Aging, 5*, 49–58.
- Albert, S. M., Castillo-Casteneda, C., Sano, M., & Jacobs, D. M. (1996). Quality of life in patients with Alzheimer's disease as reported by patient proxies. *Journal of the American Geriatrics Society, 44*, 1342–1347.
- Arbuckle, J. L. (2003). *Amos 5.0*. Chicago, IL: SPSS.
- Beck, S. H., & Page, J. W. (1988). Involvement in activities and the psychological well-being of retired men. *Activities, Adaptation, and Aging, 11*, 31–47.
- Blessed, G., Tomlinson, B. E., & Roth, M. (1968). The association between quantitative measures of dementia and of senile change in the cerebral grey matter of elderly subjects. *British Journal of Psychiatry, 114*, 797–811.
- Brandt, J. (2007). 2005 INS Presidential address: Neuropsychological crimes and misdemeanors. *Clinical Neuropsychologist, 21*, 553–568.
- Derogatis, L. R., & Melisaratos, N. (1983). The Brief Symptom Inventory: An introductory report. *Psychological Medicine, 13*, 595–605.
- Feinberg, L. F., & Whitlatch, C. J. (2001). Are persons with cognitive impairment able to state consistent choices? *Gerontologist, 41*, 374–382.
- Folstein, M., Folstein, S., & McHugh, P. (1975). "Mini-mental state": A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*, 189–198.
- Graff, M. J. L., Vernooij-Dassen, M. J. M., Thijssen, M., Dekker, J., Hoefnagels, W. H. L., & Rikkert, M. G. M. O. (2006). Community based occupational therapy for patients with dementia and their caregivers: Randomised controlled trial. *British Medical Journal, 333*, 1196–2001.
- Herzog, A. R., Franks, M. M., Markus, H. R., & Holmberg, D. (1998). Activities and well-being in older age: Effects of self-concept and educational attainment. *Psychology and Aging, 13*, 179–185.
- Horn, J. L., & McArdle, J. J. (1992). A practical and theoretical guide to measurement invariance in aging research. *Experimental Aging Research, 18*, 117–144.
- Horn, J. L., McArdle, J. J., & Mason, R. (1983). When is invariance not invariant: A practical scientist's look at the ethereal concept of factor invariance. *Southern Psychologist, 4*, 179–188.
- Hu, L.-T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1–55.
- Logsdon, R. G., Gibbons, L. E., McCurry, S. M., & Teri, L. (1999). Quality of life in Alzheimer's disease: Patient and caregiver reports. *Journal of Mental Health and Aging, 5*, 21–32.
- Logsdon, R. G., Gibbons, L. E., McCurry, S. M., & Teri, L. (2002). Assessing quality of life in older adults with cognitive impairment. *Psychosomatic Medicine, 64*, 510–519.
- Logsdon, R. G., McCurry, S. M., & Teri, L. (2007). Evidence-based interventions to improve quality of life for individuals with dementia. *Alzheimer's Care Today, 8*, 309–318.
- Logsdon, R. G., & Teri, L. (1997). The Pleasant Events Schedule-AD: Psychometric properties and relationship to depression and cognition in Alzheimer's disease patients. *Gerontologist, 37*, 40–45.
- Menec, V. H. (2003). The relations between everyday activities and successful aging: A 6-year longitudinal study. *Journal of Gerontology: Social Sciences, 58B*, S74–S82.

- Richards, M., Folstein, M., Albert, M., Miller, L., Bylsma, F., Lafleche, G., Marder, K., Bell, K., Sano, M., Devanand, D., et al. (1993). Multi-center study of predictors of disease in Alzheimer's disease (the "Predictor's Study"), II: Baseline findings. *Alzheimer Disease and Associated Disorders*, 7, 22–32.
- Sainfort, F., Becker, M., & Diamond, R. (1996). Judgments of quality of life with individuals with severe mental disorders: Patient self-report versus provider perspectives. *American Journal of Psychiatry*, 153, 497–502.
- Scarmeas, N., Levy, G., Tang, M. X., Manly, J., & Stern, Y. (2001). Influence of leisure activity on the incidence of Alzheimer's disease. *Neurology*, 57, 2236–2242.
- Selai, C. E., Trimble, M. R., Rossor, M., & Harvey, R. J. (2001). Assessing quality of life in dementia: Preliminary psychometric testing of the Quality of Life Assessment Schedule (QOLAS). *Neuropsychological Rehabilitation*, 11, 219–243.
- Stern, Y., Albert, S. M., Sano, M., Richards, M., Miller, L., Folstein, M., Albert, M., Bylsma, F. W., & Lafleche, G. (1994). Assessing patient dependence in Alzheimer's disease. *Journal of Gerontology: Medical Sciences*, 49, M216–M222.
- Stern, Y., Folstein, M., Albert, M., Richards, M., Miller, L., Bylsma, F., Lafleche, G., Marder, K., Bell, K., Sano, M., et al. (1993). Multi-center study of predictors of disease course in Alzheimer's disease (the "Predictors Study"), I: Study design, cohort description, and intersite comparisons. *Alzheimer Disease and Associated Disorders*, 7, 3–21.
- Stern, Y., Sano, M., Paulsen, J., & Mayeux, R. (1987). Modified Mini-Mental State Examination: Validity and reliability. *Neurology*, 37(Suppl. 1), 179.
- Teri, L., & Logsdon, R. G. (1991). Identifying pleasant activities for Alzheimer's disease patients: The Pleasant Events Schedule-AD. *Gerontologist*, 31, 124–127.
- Teri, L., Logsdon, R. G., Uomoto, J., & McCurry, S. (1997). Behavioral treatment of depression in dementia patients: A controlled clinical trial. *Journal of Gerontology: Psychological Sciences*, 52, P159–P166.
- Teri, L., McCurry, S. M., Logsdon, R. G., & Gibbons, L. E. (2005). Training community consultants to help family members improved dementia care: A randomized controlled trial. *Gerontologist*, 45, 802–811.

Received October 6, 2008

Accepted July 27, 2009

Decision Editor: Rosemary Blieszner, PhD