

Everyday problem solving in Alzheimer's patients: a comparison of subjective and objective assessments

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Abstract

Patient self-reports, caregiver reports and objective measures are commonly employed methods of assessing everyday cognitive competence. However, little research has examined the relationship among them. The current study assessed the congruence among Alzheimer's patients' and their caregivers' ratings of patient performance on instrumental activities of daily living (IADLs) and scores on an objective measure of everyday competence, the Everyday Problems Test for the Cognitively Challenged Elderly (EPCCE). The effects of patient and caregiver characteristics on these relationships were also examined. Participants included 63 patient/caregiver dyads who were part of a larger, ongoing longitudinal study at the Stanford Aging Clinical Research Center. Significant positive relationships between patient and caregiver ratings and between each of these ratings and EPCCE scores suggest that both informant groups perceive the pattern of AD patients' everyday cognitive decline similarly, and that patients are aware of their own decline. MANOVA results demonstrate greater agreement between patient and caregiver ratings when the patient is young-old. Relative to performance on the EPCCE, female patients overestimate while male patients underestimate IADL abilities. Characteristics of the caregiver were not associated with the congruence measures. Post hoc analyses indicate that disease severity mediates the impact of some patient attributes on the measures of congruence of competence.

The decision to intervene in the independence of an older adult is largely precipitated by the concerns of the caregiver who questions their frail elder's ability to safely and adequately perform instrumental activities of daily living (IADL; Lawton & Brody, 1969) such as preparing meals, making emergency phone calls and handling finances. In fact, there is a strong reliance on caregiver reports when the cognitive competence of the older adult is brought into question (Kiyak et al., 1994; Loewenstein et al., 1989). That is, once a diagnosis of dementia has been made, judgements regarding the infirm adult's functional ability as well as decisions regarding his or her everyday living are often delegated to the caregiver.

The irreversible deterioration of memory and intellectual competence associated with Alzheimer's disease (AD) eventually leads to an inability to carry out basic and instrumental tasks deemed necessary for successful independent functioning (Lawton & Brody, 1969). However, because the degenerating symptoms of AD usually manifest gradually over a potentially long period of time (i.e. 10–20 years; Aneshensel et al., 1995) many Alzheimer's patients could spend years living in the community and carrying out essential tasks of daily living, albeit under increasing degrees of supervised care. Therefore, a gradual decline in the opportunity to function independently, reflecting only domains in which loss

has occurred, may be more appropriate than denying Alzheimer's patients the opportunity to function in all domains of everyday living.

Ignoring the impaired adult's self-assessment in lieu of caregiver reports, especially in the early stages of dementia, may be overlooking an important piece of the functional assessment puzzle. Further, a lack of congruence between caregiver and patient assessments of competence may result in negative outcomes for the patient and the caregiver. For instance, if the caregiver regularly underestimates areas of competence, the patient may be deprived of the stimulation and efficacy associated with carrying out everyday activities.

AD patients' versus caregivers' reports

Previous research has analyzed the association of self-reports and caregiver reports of the patient's functional competence. These investigations reveal that AD patients' self-report ratings are consistently higher than the ratings of their caregivers (e.g. Kuriansky et al., 1976; McGlynn & Kaszniak, 1991). Further, reporting on a longitudinal assessment of patient self- and caregiver reports, Kiyak et al. (1994) found that a significant discordance is maintained over time between caregiver ratings and AD patients' reports of self-care and instrumental ADL skills.

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Received for publication 2nd February 1999. Accepted 21st June 1999.

ISSN 1360-7863 print/ISSN 1364-6915 online/99/040281-13 © Taylor & Francis Ltd

Patients rated themselves higher at all measurement points (i.e. five occasions of testing) than did caregivers. These findings suggest that it is quite typical for the caregiver's perception of the cognitive ability of their infirmed relation to be lower than that of the patient's self-perception of competence. Kiyak et al. note, however, that although patient reports of functional ability were consistently higher than caregiver reports, patient self-reports did in fact reflect decline over time, suggesting that AD patients may also be aware of decrements in their functional ability.

Impact of disease severity on AD patients' versus caregivers' reports

Grut *et al.* (1993), examining memory complaints among a sample of older adults report that the highest percentage of participants reporting memory complaints were those who scored in the moderate (16–25) and low (6–10) ranges on the MMSE. The groups with high (26–30) and very low (0–5) MMSE scores had the lowest percentage of participants reporting memory complaints. Different results were found for informants reporting on the memory impairment of this same group of adults. Informant ratings of impairment increased linearly as the scores on the MMSE decreased.

Work by Kiyak *et al.* (1994) and McGlynn and Kaszniak (1991) support these results. These investigators report findings that indicate that caregiver ratings are significantly correlated with decline in cognitive functioning and culminate in a larger disparity between family and patient reports as cognitive functioning decreases. However, Karagiozis *et al.* (1998) report conflicting findings. The results of their investigation suggest that there is no relationship between informant reports and disease severity.

Comparison of subjective and objective measures

In a comprehensive review of their research on the course and factors that influence the caregiving role, Aneshensel *et al.* (1995) report that caregivers are quite accurate in evaluating patient cognitive performance as measured by the MMSE (Folstein *et al.*, 1975). Yet, in a study that compared dementia patients' functional performance with caregivers' ratings, DeBettignies *et al.* (1993) found that caregivers of AD patients report greater levels of impairment than patients actually demonstrate on an objective test of functional performance (i.e. Structured Assessment of Independent Living Skills (SAILS); Mahurin *et al.*, 1991). Similarly, Karagiozis *et al.* (1998) found that caregivers underestimate patients' IADL abilities relative to an objective measure (i.e. Direct Assessment of Functional Abili-

ties; DAFA). Examination of the factors that impact the discrepancy between caregiver ratings and objective assessment has been limited.

Although in some studies, caregivers have been found to demonstrate a negative bias when reporting on patient IADL functioning relative to objective measures, research comparing patient self-reports with objective measures have revealed a positive bias. The work by Karagiozis *et al.* (1998) demonstrates inflated self-reports when compared to the DAFA. Further, McGlynn and Kaszniak (1991) assessed mean accuracy scores on Cognitive Task Performance Predictions and reported a trend in AD patients to over-predict their performance.

Merits of subjective and objective assessments of IADLs

Subjective and objective reports are both valuable methods of obtaining information regarding patients' everyday competence. First, because subjective reports are relatively quick, easy to administer and easy to answer they serve as useful initial screening tools for determining functional competence (Fillenbaum, 1985). In addition, although reporter bias is inherent in subjective ratings, numerous studies have demonstrated the reliability and validity of these measures (e.g. Fillenbaum, 1985; Green *et al.*, 1993; Kemp & Mitchell, 1992; Lawton & Brody, 1969). Further, caregiver ratings are especially useful when the cognitive decline associated with AD renders patient self-assessments unreliable (Kaszniak, 1996).

In contrast to subjective reports, performance-based measures afford an opportunity to objectively assess a patient's skills associated with specific everyday tasks of daily living and are, therefore, less likely than subjective ratings to be contaminated by rater biases. In addition, objective, performance-based scales provide a validation tool against which patient and caregiver ratings can be measured. However, objective measures also have limitations that should be noted such as the length of their administration and their relationship with patient education (Bertrand *et al.*, 1995) or with patient physical ability (Zanetti *et al.*, 1989). It is clear that both subjective and objective assessments of everyday cognitive competence have advantages and limitations, and to date, none represent a gold standard for the assessment of everyday competence.

Purpose of the study

Although patient self-ratings, caregiver ratings and objective measures are commonly employed, useful tools, little research have examined the congruence among them. In addition, few investigations have explored factors that may mediate their congruence. This article reports on a study that was designed to

examine three measures of functional competence and to assess the congruence or discrepancies among them. The three measures assessed Alzheimer's patients' and caregivers' perceptions of patients' competence to perform IADLs and patients' objective performance on a test of everyday problem solving. The research addressed two primary issues: (1) the relationship among the three measures of functional competence and the association of background characteristics on these measures, and (2) the congruence between each pair of competence measures with consideration to the factors that mediate the magnitude of the congruence.

Methods

Participants

Participants were 63 community-dwelling Alzheimer's patients who were enrolled in The Stanford Longitudinal Alzheimer's Project conducted at the Stanford Medical Center's Aging Clinical Research Center (ACRC) and their primary caregivers. A sub-set of these participants ($n = 44$) were also part of an ongoing caregiver investigation (i.e. The Caregiver Project: Gallagher-Thompson *et al.*, 1992).

Patients. The patient gender composition of this sample was 29 (46%) males and 34 (54%) females. Participants ranged in age from 50 to 89 years, with a mean of 74 years ($SD = 8.5$). Their educational attainment ($M = 13$ years) was higher than the US national average of 12 years (US Census, 1990). The sample was predominantly Caucasian 84%; 6% Hispanic, 5% Asian, 2% African American, and 3% who were reported as other. Participants met the National Institute of Neurological and Communicative Disorders—Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA; McKhann *et al.*, 1984) criteria for probable AD as determined by a consensus diagnosis made by an onsite multidisciplinary team. The average Mini-Mental State Examination (MMSE; Folstein *et al.*, 1975) score for this sample was 19.70 ($SD = 3.97$, range = 12–28). MMSE scores were distributed as follows: 20% of the participants scored between 28 and 24, 33% ranged from 23 to 20, 38% ranged from 19 to 15 and 10% scored at or below 14. The average Global Deterioration Scale (GDS) score was 4.29 ($SD = 0.70$, range = 3–6), suggesting moderate to moderately severe cognitive impairment.

Caregivers. Sixty-nine per cent ($n = 43$) of the caregivers were female, with a mean age of 63 years ($SD = 12.68$, range = 35–84). Similar to the patient sample, the level of education was higher than the US average (i.e. 12 years; US Census, 1990) with a mean of 14.2 years of schooling. Eighty-nine per cent of the caregivers were Caucasian, with the remaining

caregiver participants comprising 2% African American, 5% Asian and 5% Hispanic.

Annual income for caregivers was also higher than US per capita figures (median = \$14,420; US Census, 1990), with over 40% ($n = 24$) of the sample receiving an income of \$50,000 and above, 46% ($n = 27$) of the sample earning between \$20,000 and \$50,000, and 14% ($n = 8$) earning under \$20,000. Demographic data were missing for one caregiver because the patient declined to enter the study after initial everyday cognitive testing. At initial testing, only patient information was gathered.

To be eligible for the study, caregivers had to be the primary provider of care and had to reside with the patient. Sixty-nine per cent ($n = 43$) of the caregivers were spouses of the Alzheimer's patient enrolled in this study (i.e. 29% husbands; 40% wives). The majority of the remaining sample of caregivers (26%; $n = 16$) were the children of the patients (2% sons; 24% daughters). One caregiver (2%) was the sibling (i.e. brother) and two caregivers (3%) were friends of the patient.

Procedures

Patient and caregiver participants were assessed at the Stanford University/VA Alzheimer's Center, Palo Alto, California. Participants, who were part of a larger, longitudinal research effort at the ACRC (Brooks *et al.*, 1993), were assessed at six-month and yearly intervals by trained examiners or staff clinicians on a battery of tests including the IADL Patient and Family Interview Ratings (Lawton & Brody, 1969) and the MMSE. In conjunction with this assessment, patients were administered the EPCCE (Willis, 1993) at six-month intervals. The current study includes only first occasion EPCCE testing and the patient and caregiver IADL ratings that were collected at that time. MMSE data were gathered within three months of the first administration of the EPCCE.

Measures

Test of Everyday Problems for Cognitively Challenged Elderly (EPCCE; Willis, 1993). This 32-item open-ended test was used to measure patient's everyday cognitive competence on the seven IADL domains identified by Lawton and Brody (1969). Administered by a trained examiner, patients were presented with 16 stimuli that were reproductions of actual forms, labels, bills or charts that they may have encountered in their daily lives (e.g. an over-the-counter medicine label). They were instructed to read the stimulus material and then were asked to solve two practical problems relevant to it (e.g. how much of a particular medication should be taken in 24 hours). The total score range is 0–32, with a higher score indicating fewer cognitive difficulties. Test-retest stability of 0.81

over a six-month interval and split-half reliability of 0.87 were reported (Willis *et al.*, 1998) for this sample.

Instrumental Activities of Daily Living Ratings (IADL; Lawton & Brody, 1969). An identical version of the IADL assessment tool was administered to the patient and to the caregiver. These self-report assessment tools were used to evaluate the patient's everyday functional competence in the seven IADL domains. Responses to eight Likert scales were obtained: telephone usage (score range 0–4), food preparation (0–4), housekeeping (0–5), laundry (0–3), mode of transportation (0–5), shopping (0–4), ability to handle finances (0–3) and responsibility for own medications (0–3). Total score range was 0 to 31. Although traditionally a higher IADL score reflects greater limitation, patient and caregiver IADL scores were reversed so that higher scores reflected higher levels of functioning.

Mini-Mental State Exam (MMSE; Folstein *et al.*, 1975). The MMSE is a brief cognitive screening battery used to assess global cognitive ability and was administered to the patient by a staff clinician. Domains of cognitive functioning include orientation, immediate and delayed recall for words, attention and concentration, language and praxis. Scores range from 0 to 30, with higher scores representing better functioning.

Transformation of IADL scales

The disparity in response scales for IADL domains is a well recognized concern in research using the traditional IADL measure (Furner *et al.*, 1995; Lawton & Brody, 1969). It has been common practice to use the summed score of Likert items to represent functional limitations in instrumental activities, although this practice can produce misleading summary scores since greater weight is assigned to those domains represented by Likert items with a greater number of points. For example, the ability to handle transportation needs is rated on a six-point Likert scale, while responsibility for medication is scored on a four-point Likert scale. In this case, an individual's ability to handle transportation is given more weight in the total, summed score than his/her ability to handle medications. To address this disparity, IADL Likert items were transformed such that each IADL item was equally weighted on a 100-point scale, with the maximum score summed across eight domains being 800. For example, on a traditional three-point Likert item, each point on the transformed scale was 33.3. In addition, transformed scores were reversed, thereby representing functional competence rather than functional limitations in order to gain uniformity in directionality of scores across measures. After transformation, a score of 0 indicated that the patient did not perform the activity, while a score of 100 denoted that the patient was able to carry out the activity with complete independence.

Results

This study addressed two major questions. First, we examined the relationship between the three measures of functional competence, the Patient and Caregiver IADLs and the EPCCE, and considered the impact of demographic variables on these measures. Second, we investigated the congruence between each pair of competence measures. The variables accounting for significant variance for each congruence measure were also examined.

Congruence is defined as the discrepancy or difference between two of the competency measures. Thus, three congruence scores were considered: (1) Congruence I: the congruence of patient and caregiver perceptions of patient competence (patient IADL ratings less caregiver IADL ratings); (2) Congruence II: the congruence of patient self-perception of competence and performance on an objective measure of cognitive performance (patient IADL ratings less EPCCE scores); and (3) Congruence III: the congruence of caregiver perception of patient's competence and patient's performance on an objective measure of cognitive performance (Caregiver IADL ratings less EPCCE).

Relationship among the competency measures and with demographic variables

Table 1 presents the means, standard deviations and ranges in raw score form for the three competency measures, for the MMSE, and for the congruence scores to be discussed in the second part of the results section. Table 2 presents the correlations among the three competency measures, patient and caregiver characteristics and congruence scores. Note that in Tables 1 and 2 both traditional and transformed IADL scores are included for the purpose of comparison. The traditional and transformed IADL scores for the same competency measure (i.e. patient, caregiver) were highly correlated ($p < 0.001$) as would be expected; the negative relationship is due to the traditional scores representing level of limitation, while the transformed scores represent level of functional ability. Only transformed scores were used in the analyses reported here.

Correlational analyses revealed a significant association among all three competence measures—between patient and caregiver IADL ratings ($r = 0.47$, $p < 0.001$); between patient IADL ratings and the EPCCE ($r = 0.30$, $p < 0.05$); and between caregiver IADL ratings and the EPCCE ($r = 0.25$, $p < 0.05$).

Significant relationships between competency scores and patient characteristics but not caregiver characteristics were revealed. A statistically significant negative correlation was found between patient age and caregiver IADL ratings ($r = -0.48$, $p < 0.001$), indicating that the caregiver's perception of patient

TABLE 1. Descriptive statistics: measures ($N = 63$)

Measure	M	SD	Range
EPCCE	14.16	7.18	02-32
Caregiver IADL	17.49	5.86	05-30
Caregiver IADL ^a	357.65	176.12	25-800
Patient IADL	14.03	4.94	04-26
Patient IADL ^b	480.86	175.64	25-775
MMSE	19.70	3.97	12-28
Congruence I ^c	123.21	180.36	-259-609
Congruence II ^d	0 ^f	11.82	-31-21
Congruence III ^e	0 ^f	12.27	-26-27

Note. Caregiver IADL^a = caregiver IADL total reversed, rescaled to 800; patient IADL^b = patient IADL total reversed, rescaled to 800; Congruence I^c = total reversed, rescaled to 800 patient IADL less total reversed, rescaled to 800 caregiver IADL; Congruence II^d = total reversed, rescaled to 800, standardized patient IADL less standardized EPCCE total; Congruence III^e = total reversed rescaled to 800, standardized caregiver IADL less standardized EPCCE total. ^fMean for Congruence II and Congruence III are 0 because the component measures have been standardized.

IADL abilities decreases as a function of the patient's age. The patient MMSE was significantly associated with the EPCCE ($r = 0.51$, $p < 0.001$).

Impact of patient and caregiver characteristics on competency scores. A series of regression analyses were conducted to examine whether the relative influence of patient and caregiver characteristics varied across the three competency measures.

Hierarchical regression models predicting EPCCE total scores were formed by entering MMSE total scores in the first step followed by patient and caregiver demographic variables in the second step (see Table 3). MMSE was found to account for significant variance in EPCCE total scores, $F(1, 57) = 23.52$, $p < 0.001$, $R^2 = 0.29$. The inclusion of the patient and caregiver demographic characteristics did not significantly increase the amount of variance explained in the EPCCE total scores, $F(6, 52) = 4.89$, $p < 0.001$, $R^2 = 0.36$.

A hierarchical regression model predicting transformed caregiver IADLs was conducted entering MMSE total scores in the first step followed by patient

and caregiver demographic variables in the second step (see Table 3). The MMSE did not demonstrate a significant contribution to the variance explained, $F(1, 57) = 3.21$, $p < 0.08$, $R^2 = 0.05$. However, there was a significant change in R^2 when the demographic variables were added in step two, $F(6, 52) = 3.86$, $p < 0.01$, $R^2 = 0.31$, change in $R^2 = 0.25$. Patient age accounted for significant variance in caregiver IADL ratings.

Agreement among measures of competence. Figures 1a and b show plots for patient versus caregiver transformed IADL ratings. Given that regression analyses indicate age of the patient as a significant predictor of caregiver IADL ratings, Figure 1a presents a plot of patient versus caregiver ratings for young-old patients (≤ 75), while Figure 1b presents a plot of patient versus caregiver ratings for old-old patients (> 75). A higher score on both competence measures indicates a rating of higher functional ability. Figure 1a indicates the positive bias of young-old patients' perceptions of functional ability over that of the ratings of their caregivers. Young-old patients

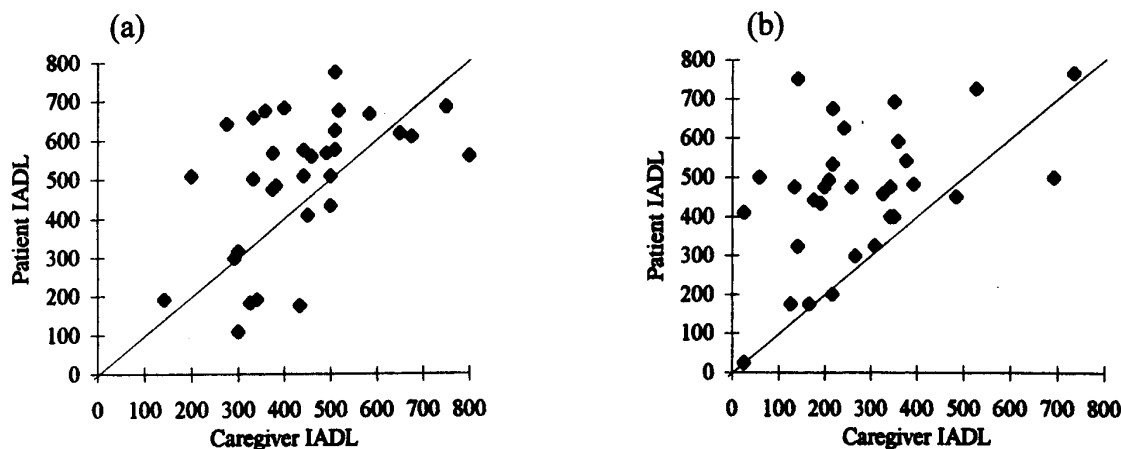


FIG. 1. (A) Plot of patient versus caregiver IADL ratings for young-old patients (≤ 75). (B) Plot of patient versus caregiver IADL ratings for old-old patients (> 75).

TABLE 2. Correlation matrix of demographic, everyday competence and cognitive measures ($n = 63$)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Patient's age	-0.12												
2. Patient's education	-0.01	0.04											
3. Caregiver's age	-0.11	0.46***	-0.40***										
4. Caregiver's education	0.08	-0.30*	-0.21	0.10									
5. Patient IADL	-0.09	0.21	-0.12	0.09	-0.50***								
6. Patient IADL ^a	0.38**	-0.23	-0.21	0.09	0.53***	-0.05							
7. Caregiver IADL	-0.48***	0.19	-0.06	0.09	-0.38**	0.47***	-0.63***						
8. Caregiver IADL ^b	0.07	0.09	-0.004	-0.16	-0.24	0.30*	-0.20	0.25*					
9. EPCCE	0.39**	0.02	-0.06	0.003	0.50***	0.51***	0.57***	-0.51***	0.05				
10. Congruence I ^c	-0.14	0.10	-0.10	0.22	-0.22	0.59***	0.13	0.19	-0.59***	0.39**			
11. Congruence II ^d	-0.45***	0.08	-0.05	0.21	-0.13	0.14	-0.36**	0.61***	-0.61***	-0.46***	0.64***		
12. Congruence III ^e	-0.19	0.17	0.21	-0.15	-0.29*	0.07	-0.32*	0.24	0.51***	-0.16	-0.37**	-0.23	
13. MMSE													

Note. To maximize n for each set of correlations, analyses were run using pairwise deletion. Caregiver age ($n = 62$); Caregiver education ($n = 61$); MMSE ($n = 61$). * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Patient IADL^a = patient IADL total reversed, rescaled to 800. Caregiver IADL^b = caregiver IADL total reversed, rescaled to 800; Congruence I^c = total reversed, rescaled to 800 patient IADL less total reversed, rescaled to 800 caregiver IADL; Congruence II^d = total reversed, rescaled to 800, standardized patient IADL less standardized EPCCE total; Congruence III^e = total reversed rescaled to 800, standardized caregiver IADL less standardized EPCCE total.

TABLE 3. Summary of hierarchical regression analyses for variables predicting EPCCE total score and caregiver IADL summary score (N = 63)

Variable	EPCCE score				
	B	t	p	R ²	R ² change
Step 1 ^a					
MMSE	0.54	4.85	0.000	0.29	
Step 2 ^b					
MMSE	0.59	4.69	0.000		
Patient age	0.13	1.11	0.271		
Patient gender	0.11	0.89	0.379		
Patient education	0.12	0.93	0.357		
Caregiver age	-0.20	-1.59	0.117		
Caregiver education	-0.21	-1.47	0.147	0.36	0.07
Variable	Transformed caregiver IADL ^c				
	B	t	p	R ²	R ² change
Step 1 ^d					
MMSE	0.23	1.79	0.079	0.05	
Step 2 ^e					
MMSE	0.21	1.63	0.110		
Patient age	-0.42	-3.51	0.001**		
Patient gender	0.17	1.32	0.193		
Patient education	0.17	1.20	0.235		
Caregiver age	-0.16	-1.20	0.235		
Caregiver education	-0.08	-1.47	0.147	0.31	0.25**

Note. ^aF(1,57) = 23.52, p < 0.001, R² = 0.29; ^bF(6,52) = 4.89, p < 0.001, R² = 0.36; ^cCaregiver IADL total score reversed, rescaled to 800; ^dF(1,57) = 3.21, p < 0.08, R² = 0.05; ^eF(6,52) = 3.86, p < 0.01, R² = 0.31, change in R² = 0.25; *p < 0.05; **p < 0.01; ***p < 0.001.

overestimated their level of functioning compared to that of their caregivers. The trend toward a positive patient bias was more clearly demonstrated among old-old patients. Figure 1b illustrates that old-old patients were much more likely to rate their functional ability higher than their caregivers.

Figures 2a and b present plots for patient IADL versus EPCCE scores. Given that regression analyses indicated the MMSE to be a significant predictor of

EPCCE scores, Figure 2a presents a plot of patient IADL ratings for patients equal to or above the MMSE mean versus EPCCE scores, while Figure 2b presents a plot of patient IADL ratings for patients below the MMSE mean versus EPCCE scores. At first glance, the scatter of data points in Figures 2a and b suggest that, relative to EPCCE scores, patients did not discriminate by over- or underestimating their IADL performance based on their MMSE status.

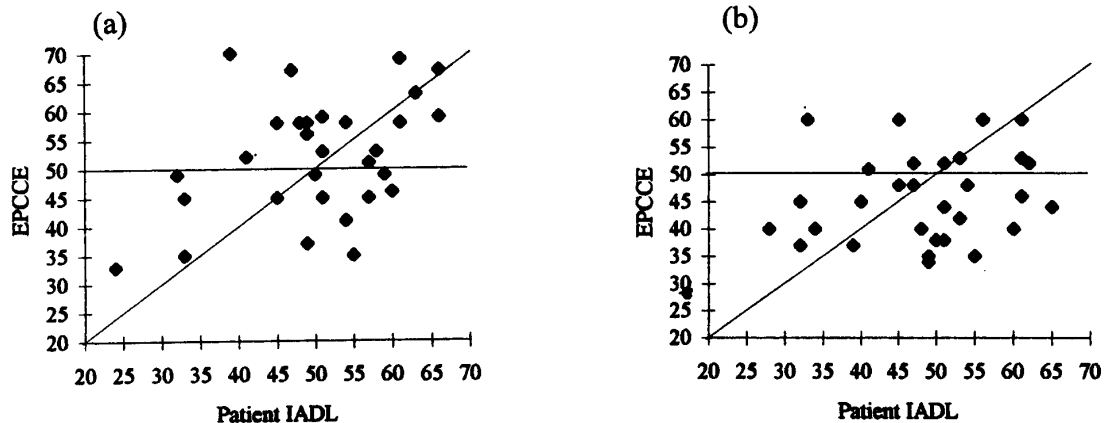


FIG. 2. (A) Plot of patient IADL ratings versus EPCCE for patients scoring at or above the MMSE mean. (B) Plot of patient IADL ratings versus EPCCE for patients scoring below the MMSE mean.

However, if the plots are examined according to those patients who fell below or above the mean on the EPCCE, an interesting pattern emerges. That is, regardless of MMSE status, patients who scored below the EPCCE mean were more likely to overestimate their functional ability relative to the EPCCE. In contrast, it was twice as common for patients who scored above the EPCCE mean to underestimate their functional ability relative to the EPCCE.

Figures 3a and b present the caregiver IADL versus EPCCE scores. Given that regression analyses indicated the MMSE to be a significant predictor of EPCCE scores, Figure 3a presents a plot of caregiver IADL ratings for patients equal to or above the MMSE mean versus EPCCE scores, while Figure 3b presents a plot of caregiver IADL ratings for patients below the MMSE mean versus EPCCE scores. Figures 3a and b show similar patterns to those discussed in Figures 2a and b. Relative to the EPCCE, caregivers overestimated when patients fell below the EPCCE mean and underestimated when patients scored above the EPCCE mean, regardless of MMSE status. In general, however, when considering those participants who scored higher on the MMSE (i.e. > 19.7; see Figure 3a), caregivers were more likely to overestimate functional ability relative to the EPCCE and for patients who produced lower MMSE scores (i.e., < 19.7; see Figure 3b), caregivers tended to underestimate functional abilities.

Congruence among three competence measures

The second major question of the study addressed the discrepancy or convergence between each pair of competence measures. The impact of patient and caregiver characteristics on convergence or discrepancy between pairs of competence scores was examined.

Creating congruence measures. To examine the degree of congruence among the three measures of competency three difference scores were calculated:

Congruence I: patient minus caregiver IADL ratings; Congruence II: patient IADL ratings minus EPCCE scores; and Congruence III: caregiver IADL ratings minus EPCCE scores. Based on the a priori notion that patients overestimate their everyday cognitive competence, caregiver IADL ratings and EPCCE scores were subtracted from patient IADL ratings. In calculating two of the measures of congruence (i.e. Congruence II and III), the component competency scores were standardized to t-scores ($M = 50$, $SD = 10$) before computing the difference score. T-scores were computed for the component competency scores so that the two measures used to derive the congruence measures would be in the same metric. For the third congruence score (i.e. Congruence I), the reversed and rescaled component scores were used in computing the difference score. Components of this congruence score were not standardized because they were on the same metric. Table 1 presents the means for the three convergence measures, and Table 2 presents the correlation of the three convergence scores among themselves and with patient and caregiver characteristics.

Analyses revealed a significant association between Congruence I and Congruence II and Congruence III ($r = 0.39$, $p < 0.01$ and $r = -0.46$, $p < 0.001$, respectively). A statistically significant correlation was also demonstrated between Congruence II and Congruence III ($r = 0.64$, $p < 0.001$). The relationships of the independent variables (i.e. patient and caregiver age and education) to the three congruence measures were also examined. As shown in Table 2, patient age was significantly correlated with Congruence I and Congruence III. In particular, a significant positive relationship was demonstrated between patient age and Congruence I ($r = 0.39$, $p < 0.01$) and a statistically significant negative correlation was shown between patient age and Congruence III ($r = -0.45$, $p < 0.001$). No other patient or caregiver characteristics were found to be significantly related to the measures of congruence.

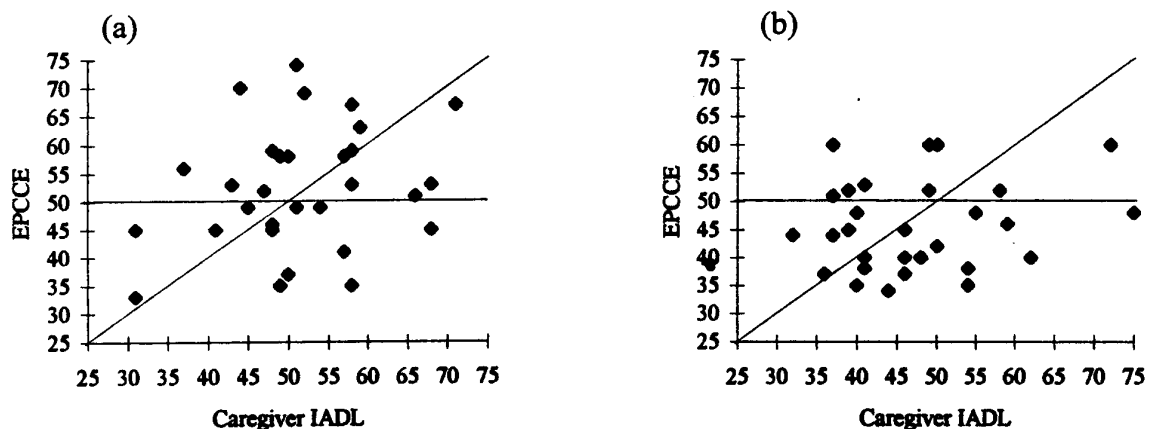


FIG. 3. (A) Plot of caregiver IADL ratings versus EPCCE for patients scoring at or above the MMSE mean. (B) Plot of caregiver IADL ratings versus EPCCE for patients scoring below the MMSE mean.

Impact of Patient Characteristics on the Measures of Congruence. A 2 (age) \times 2 (gender) \times 2 (education) MANOVA with the independent variables representing patient characteristics was performed on three dependent variables representing the measures of congruence. Based on Wilks' criterion, the combined dependent variables were significantly affected by patient age, $F(3,53) = 0.75$, $p < 0.01$; patient gender, $F(3,53) = 0.85$, $p < 0.05$; and the interaction of patient age by gender, $F(3,53) = 0.86$, $p < 0.05$.

Univariate analyses revealed significant main effects for patient age on Congruence I, $F(1, 55) = 8.48$, $p < 0.01$, and Congruence III, $F(1,55) = 10.40$, $p < 0.01$. Patient and caregiver IADL ratings were significantly more congruent for the group of young-old patients than for the old-old group (young-old: $M = 48.73$, old-old: $M = 179.01$). Further, caregivers of old-old patients rated patient IADL ability lower compared to EPCCE scores ($M = -4.58$); while for young-old subjects, caregiver ratings were higher than EPCCE scores ($M = 4.65$). Significant effects were also revealed for patient gender on Congruence II, $F(1,55) = 8.71$, $p < 0.01$. Female patients' IADL ratings were higher than male IADL ratings as compared to EPCCE scores (female: $M = 3.69$, male: $M = -4.68$). Finally, a significant interaction effect for patient age by gender on Congruence III was demonstrated, $F(1, 55) = 6.81$, $p < 0.05$. Relative to EPCCE scores, caregivers of young-old females overestimated patient ability ($M = 10.72$) and caregivers of old-old females underestimated patient competence ($M = -5.98$).

Disease severity as a mediator of the impact of patient characteristics. Further analyses were conducted to examine the mediating influence of disease severity (i.e. measured by the MMSE) on the effects of patient characteristics on congruence. A 2 (patient age) \times 2 (patient education) \times 2 (patient gender) between-subjects multivariate analyses of covariance (MANCOVA) was performed on the three congru-

ence measures. Univariate results of these analyses are presented in Table 4.

Similar to the findings reported on the prior MANOVA results, after adjusting for the covariation effects of disease severity, significant main effects were revealed for patient age on Congruence I, $F(1,52) = 6.53$, $p < 0.05$ and Congruence III, $F(1,52) = 12.27$, $p < 0.001$, and for the interaction of patient age by gender on Congruence III, $F(1,52) = 7.75$, $p < 0.01$. However, after covariation two differences from the pattern of MANOVA results were found. First, the gender main effect for Congruence II was no longer significant. Second, the age by gender interaction for Congruence II was significant, $F(1,52) = 4.17$, $p < 0.05$; it had not been significant in the MANOVA. After covariation for disease severity a significant mean group difference between young-old men ($M = -4.80$) and young-old women ($M = 6.55$) was demonstrated. Compared to scores on the EPCCE, young-old men underestimated their everyday cognitive competence and young-old women overestimated their competence. These results suggest that the effects of patient characteristics on congruence of competence may be mitigated by the severity of the disease.

Impact of caregiver characteristics on congruence scores. A multivariate analysis of variance (MANOVA) was conducted to examine the impact of caregiver characteristics on the measures of congruence. The following caregiver groups were formed: caregiver young-old (≤ 65) and old-old (> 65); caregiver low educated (≤ 14 years of education) and high educated (> 14 years of education). Caregiver gender was not considered in this study because of the large proportion of female caregivers (i.e. 69%). The measures of congruence represented by difference scores served as the dependent variables in this design.

To analyze the impact of caregiver characteristics on the measures of congruence, a 2 (age) \times 2 (education) MANOVA with the independent variables

TABLE 4. Multiple analysis of covariance for effects of patient characteristics on the measures of congruence of competence with disease severity (MMSE^d) as a covariate ($n = 61$)

Effect	Congruence I ^a F(df)	Congruence II ^b F(df)	Congruence III ^c F(df)
Patient age	6.53 (1,52)*	1.30 (1,52)	12.27 (1,52)***
Patient gender	1.19 (1,52)	3.64 (1,52)	00.74 (1,52)
Patient education	0.37 (1,52)	0.92 (1,52)	00.14 (1,52)
Patient age \times gender	0.69 (1,52)	4.17 (1,52)*	07.75 (1,52)**
Patient age \times education	2.08 (1,52)	2.02 (1,52)	00.003 (1,52)
Patient gender \times education	0.12 (1,52)	0.76 (1,52)	00.29 (1,52)
Patient age \times gender \times education	0.09 (1,52)	0.17 (1,52)	00.01 (1,52)
MS error	29751.82	107.13	110.34

Note. Congruence I^a = difference score of total reversed, rescaled to 800, patient IADL less total reversed, rescaled to 800 caregiver IADL total; Congruence II^b = total patient IADL, reversed and standardized less total EPCCE standardized; Congruence III^c = total caregiver IADL, reversed and standardized less total EPCCE standardized; MMSE^d = Mini-Mental State Exam; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

representing caregiver characteristics was performed on the three measures of congruence of competence. Main effects for caregiver age or education on the combined dependent variables were not observed. Therefore, MANCOVA post hoc analyses were not conducted for caregiver characteristics.

Discussion

The current study was designed to examine three measures of AD patients' competence in functional tasks of daily living. Of particular concern was the congruence of Alzheimer's patients' and caregivers' perceptions of patients' competence and the congruence of patient and caregiver perceptions to an objective test of everyday cognitive competence (i.e. EPCCE). Patient and caregiver characteristics and the possible mediating factor of disease severity were also analyzed for their impact on the congruence measures.

The major findings of this study were twofold. First, the three measures of competence were positively related. However, the factors that accounted for variance in the three measures varied. Second, three measures of congruence were examined and the characteristics of the patient, not the caregiver, were associated with these measures of congruence.

Association among measures of competence

A significant, positive association was found among all three measures of competence. These results support the work of Cavanaugh *et al.* (1989) and Kiyak *et al.* (1994), who found that in addition to the caregiver's awareness of the AD patient's cognitive decline, patients themselves are aware of their deterioration and express it in their self-assessment. Although patients' ratings are positively biased, at least in the early stages of the disease, they are somewhat accurate in their functional assessments. The current findings also support those of Loewenstein *et al.* (1989), who found a significant relationship between performance on the Direct Assessment of Functional Status and caregiver ratings of patients' functional ability.

Only patient characteristics, not caregiver, were significantly correlated with the competence measures. That is, patient age was negatively associated with caregiver IADL ratings. It is likely that because disease severity increases concurrently with age, caregivers' IADL ratings reflect patients' cognitive degeneration that is associated with the disease. Although patients may be able to contribute IADL information during the early stages of the disease, increased disease severity concomitant with increased age inhibits self-awareness and the ability to report on everyday cognitive status. No other patient or caregiver attributes were associated with the competence measures. It

was surprising that patient education did not demonstrate a relationship with EPCCE scores since one would expect higher scores from more highly educated patients. Previous research has linked lower education level with increased errors on the EPCCE (Bertrand *et al.*, 1995). It is possible that a larger sample would reveal different results concerning the relationship between patient and caregiver education and scores on the EPCCE.

The significant predictor of the EPCCE was the MMSE. This finding lends support to a previous study (Dolan *et al.*, 1995) which established the validity of the EPCCE measure with the MMSE in a cognitively normal, low SES sample of rural old adults. The present finding serves to reiterate the usefulness of the EPCCE as a tool to complement existing measures of cognitive decline or disease severity.

Interesting findings were demonstrated in Figures 2a and 2b, and 3a and 3b. Regardless of MMSE status, for scores that fell below the EPCCE mean patients and caregivers were more likely to overestimate functional ability. In contrast, for scores above the EPCCE mean, patients and caregivers underestimated patient functional ability relative to the EPCCE. These findings have two implications. First, regardless of dementia status as assessed by the MMSE, male and female patients of all ages agree with caregivers on the direction of bias in estimating IADL ability relative to patient performance on the objective measure of everyday competence. Second, when patients performed below the mean on the EPCCE, patients and caregivers reported a higher level of competence than EPCCE scores indicated, suggesting denial of the level of cognitive loss.

Impact of patient and caregiver characteristics on the measures of congruence

Of particular interest in this study was the congruence among the competence measures. Multivariate analyses of variance were used to examine the impact of patient and caregiver characteristics on the measures of congruence of competence. Overall, patient characteristics were shown to impact the measures of congruence, whereas caregiver characteristics were not.

Congruence I: patient IADL minus caregiver IADL. Results showed significant main effects for patient age on Congruence I. It appears that when the patient is young-old, there is greater agreement on IADL ratings between the patient and caregiver than when the patient is old-old. Three possible explanations may help to explain this finding. First, as previously discussed, older patients may not have as realistic a perspective concerning their IADL abilities as younger patients due to the progression of the disease associated with older age. Therefore, the

ratings of young-old patients will be more accurate, ergo more in sync, with caregivers' ratings than old-old patients. Second, caregivers, on the one hand, may rate the cognitive performance of younger patients as higher than they rate the performance of older patients regardless of the severity of the disease. That is, in the early stages of the disease caregivers may deny the full extent of disability that encumbers their relation. On the other hand, researchers have noted that as the severity of the disease progresses (i.e. as the patient ages), caregivers may become so overwhelmed by grief and burden that they exaggerate the cognitive loss of their relations (Cohen et al., 1984). Finally, it is possible that a subtle type of ageism drives caregivers to underestimate the ability of older patients; caregivers may expect less of older subjects simply because of their age.

Congruence II: patient IADL minus EPCCE. Patient gender demonstrated an impact on the Congruence II measure. It was also found that female patients overestimate their IADL abilities relative to the EPCCE and that male patients underestimate their IADL abilities relative to the EPCCE. In other words, female patients believe that they are functioning at a cognitively higher level than scores on the objective test (i.e. EPCCE) indicate, whereas male patients believe the opposite; males believe that they are functioning lower than their test scores indicate. It is likely that among this cohort of older adults, women have more experience than men with the majority of instrumental activities that are assessed by the IADL measure (i.e. telephone use, food preparation, housekeeping, laundry, shopping, handling medication), and consequently view themselves as more competent. It is also possible that because of the social pressure traditionally placed on women of this cohort to be good housekeepers, they are reticent to acknowledge a decline in these abilities.

Congruence III: caregiver IADL minus EPCCE. Finally, in addition to the impact of age on Congruence I, significant main effects for patient age on the Congruence III measure were revealed. As expected, in this sample of older adults, when the patient is young-old the caregiver tends to overestimate patient IADL abilities and when the patient is old-old, the caregiver generally underestimates patient ability compared to EPCCE scores. A similar explanation as provided under Congruence I can be applied here. Specifically, caregivers may deny loss during the early stages when they find it difficult to accept the reality of the disease. In later stages, however, they may exaggerate cognitive loss due to feelings of grief and burden. Another explanation may be that as the disease progresses, caregivers become protective and take over tasks that the patient may still be able to perform to some degree.

Mediating effects of disease severity

Multivariate analyses of covariance with disease severity as a covariate demonstrated mediating effects on patient characteristics. Univariate analyses revealed changes in magnitude of mean gender group differences on the Congruence I measure before and after adjustment for disease severity. Prior to covariation, there was a significant mean group difference between female and male patients on this measure of congruence of competence; female patients overestimated and male patients underestimated IADL abilities relative to EPCCE scores. However, after covariation patients were not differentiated by gender on self-reports of IADL competence compared to EPCCE scores. A possible explanation for this finding is the disparity in this sample of disease severity (i.e. MMSE scores) by gender; on average women scored lower than men on the MMSE (female: $M = 18.39$; male: $M = 21.25$). Once the difference in disease severity is controlled, gender group differences are no longer statistically significant. This finding suggests that when men and women are at the same level of cognitive decline, they view their everyday cognitive competence similarly.

Most surprising, and contrary to previous rationale, is the finding that the age of the patient is an influential characteristic regardless of the stage of the disease. The most obvious explanation for this phenomenon is that patient age and disease severity are so highly associated that adjusting for the progression of the disease does not impact the measures of congruence beyond the influence of patient age. However, as demonstrated in the correlation analyses, the relationship between patient age and MMSE scores did not reach statistical significance. This explanation may still be valid, however, given that the latter finding may be a function of the small sample size; a larger sample may reveal different results. In addition, the lack of mitigating influence of disease severity may be due in part to the restricted range of the scores on the MMSE (i.e. range = 12–27). A small sample size may also explain the lack of findings regarding caregiver attributes on the measures of congruence. For the current sample, caregiver age and educational attainment failed to have a significant impact on any of the measures of congruence.

Implications

Each of the three measures of competence discussed in this study offers a different perspective on functional competence. Alone each represents a valuable assessment tool; however, taken together they offer a more complete picture. The practice of ignoring the impaired adult's contribution to self-assessment may fail to identify critical information. The results of this study have shown that individuals with moderate cognitive decline may still be able to evaluate their

abilities and provide the physician with additional information that could lead to more appropriate treatment and the implementation of simple household interventions (e.g. labeling cabinets). As our population begins to age, findings such as these have implications for the determination of the legal competence of older adults and for financial and ethical impacts on society.

Limitations and suggestions for future studies

When interpreting the results of this study, it is important to consider several factors that may limit the generalizability of these results to the larger population of patient/caregiver dyads. First, because the sample under examination was drawn from a clinical population of older adults with Alzheimer's disease, the sample size is inherently small. As a result, the research questions and the types of analyses conducted were restricted. Additional limitations include the fact that the sample is more well educated and has a higher income than the average American adult, and that the sample is predominantly Caucasian. Utilizing a larger and more diverse sample may help to answer some of the questions raised in this study and provide a more thorough examination of patients' and caregivers' perceptions of AD patients' everyday cognitive competence.

Acknowledgements

This research was supported by funding from the National Institution on Aging (AG11032) to S. L. Willis. R. M. Bertrand received predoctoral funding by Training Grant #5 T32 AG00048-20 from the National Institute on Aging.

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