

Patient's Rating of Cognitive Ability

Using the AD8, a Brief Informant Interview, as a Self-rating Tool to Detect Dementia

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Objective: To test the ability of patients to rate their own cognitive ability using the AD8 compared with informant and clinician ratings of cognitive status.

Design, Setting, and Patients: The AD8 was administered to 325 consecutive participant-informant dyads enrolled in a longitudinal study at Washington University School of Medicine between April 4, 2005, and December 15, 2005. The number of AD8 items endorsed by the participant was compared with informant answers and an independently derived Clinical Dementia Rating.

Main Outcome Measure: Strength of association was measured with Spearman (ρ) and intraclass correlation coefficients. Receiver operator characteristic curves assessed the discriminative properties of the AD8.

Results: The mean age of participants and informants was 72.8 years (range, 43-104 years) and 66.4 years (range, 24-101 years), respectively. The Clinical Dementia Rating was correlated with both informant ($\rho=0.75$, $P<.001$) and participant ($\rho=0.34$, $P<.001$) AD8 scores. Partici-

pants' AD8 scores had adequate agreement with informants' AD8 scores (intraclass correlation coefficient, 0.53; 95% confidence interval, 0.41-0.62) and correlated with subjective complaints of memory problems ($\rho=0.47$, $P<.001$) but not with estimates of symptom duration. The area under the receiver operator characteristic curve for the informant AD8 was 0.89 (95% confidence interval, 0.86-0.93); for the participant AD8, it was 0.78 (95% confidence interval, 0.68-0.78).

Conclusions: The AD8 is a brief measure that, when completed by an informant, differentiates nondemented from demented individuals. We now demonstrate that a self-completed AD8 also differentiates nondemented from demented individuals, although the utility was better in mildly impaired individuals compared with more demented individuals. In the absence of a reliable informant, the AD8 may be asked of the participant to gain an understanding of their perception of cognitive status.

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DEMENTIA IS A GROWING public health concern, affecting 10% of adults over the age of 65 years and 50% of adults over the age of 85 years.¹ Alzheimer disease (AD), the most common dementing illness, is difficult to diagnose at the earliest stages because brief measures that reliably discriminate healthy older adults from those with mild impairments of cognition are lacking.² In most clinical settings, cognitive impairment is assessed by objective testing of the patient.^{2,3} We have found, however, that informant-based assessments such as the Clinical Dementia Rating (CDR)⁴ are more sensitive to early cognitive change than cognitive tests.⁵ We used this premise to develop a brief informant interview, the AD8,⁶ which distinguishes individuals with very mild dementia from those without dementia. We have vali-

dated the psychometric properties of the AD8.² In general practice, however, a reliable informant may not always be available. We wanted to test whether there is value in asking individuals to self-rate their cognitive abilities.

Self-rating scales for dementia have not gained common use because of the perception that dementia patients lack insight and deny cognitive problems,⁷ even in mild forms of dementia.⁸⁻¹⁰ In addition, some scales such as the 64-item Memory Functioning Questionnaire^{11,12} are too long for general use. We compared the ability of research participants to rate intraindividual change in their abilities using the AD8. We then compared this rating with the informants' AD8 scores and an independently derived CDR to test whether individuals are able to detect changes in their own cognitive and functional abilities.

STUDY PARTICIPANTS

Participants were community-dwelling volunteers who enrolled in a longitudinal study of healthy aging and dementia.^{13,14} The study was initiated in 1979 and has assessed more than 3000 individuals to date. Inclusion and exclusion criteria have been described and include the absence of medical illnesses that may preclude longitudinal follow-up (ie, insulin-dependent diabetes). Participants must be English-speaking and have an available informant.^{6,7,13,14} Participants were recruited via word-of-mouth, public service announcements, and physician referrals. Both nondemented and demented participants underwent identical annual assessments. After informed consent was given, the AD8 was administered to 325 consecutive participant-informant dyads between April 4, 2005, and December 15, 2005. The AD8 was administered independently to the participant and collateral source by giving each a paper version prior to either person speaking with a clinician. The AD8 contains 8 questions asking the respondent to rate change (yes vs no) in memory, problem-solving abilities, orientation, and daily activities.^{2,6} The number of yes answers is totaled to obtain the AD8 score. A copy of the AD8 table with scoring rules appears at http://alzheimer.wustl.edu/About_Us/PDFs/AD8form2005.pdf. The Washington University human studies committee approved all procedures.

CLINICAL ASSESSMENT

Experienced clinicians conducted independent semistructured interviews with the participant and a knowledgeable informant¹⁵ to capture features suggestive of a dementing disorder.^{13,14} The assessment also included the Mini-Mental State Examination (MMSE),¹⁶ the Short Blessed Test (SBT),¹⁷ a health and medication history, and a neurological examination. An independent psychometric battery was also administered at each visit to all participants, but the results were not known to the clinician. The correlations between the informant AD8 and psychometric measures have been previously reported.² The diagnostic criteria for dementia of the Alzheimer type used in this study (impairment in memory and at least 1 other cognitive domain and interference with daily activities) are consistent with the definition from the *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) (*DSM-IV*),¹⁸ and for the "probable AD" category in the criteria from the National Institute of Neurological and Communicative Diseases and Stroke-Alzheimer's Disease and Related Disorders Association.¹⁹ When appropriate, published criteria were used for other dementing disorders such as dementia with Lewy bodies²⁰ and frontotemporal dementia.²¹

The CDR was used to determine the presence or absence of dementia and to stage its severity.²² A global CDR 0 indicates no dementia. The score CDR 0.5 represents very mild dementia or, in some cases with minimal impairment, uncertain dementia. The scores CDR 1, 2, and 3 correspond to mild, moderate, and severe dementia.² The sum of CDR boxes (CDR-SB) provides a quantitative expansion of the CDR ranging from 0 (no impairment) to 18 (maximum impairment).¹³ In our sample, the CDR 0.5 rating equates with very mild dementia²² and is the threshold to distinguish nondemented (CDR 0) from demented (CDR \geq 0.5) status. In other samples, CDR 0.5 has been used as the threshold for the diagnosis of mild cognitive impairment.²³ In both cases, the CDR can be used to detect change in cognitive abilities from prior level of function and assess interference with accustomed activities. Therefore, the CDR and CDR-SB were used as gold standards in this study.

Depressive features were assessed with screening questions based on the *DSM-IV*¹⁸ for depression asked independently of the participant and informant. Because some depressive symptoms (indecision, loss of interest, change in sleep or appetite) also may be features of dementia,²⁴ the clinician's impression of the presence or absence of depression incorporated all information from the clinical assessment. Participants were asked whether they had a problem with their memory or thinking (yes or no). If they admitted to memory problems, they were asked to estimate the duration of the memory problems.

STATISTICAL ANALYSIS

All analyses were performed using SAS (SAS Institute, Cary, NC). Descriptive statistics were used to report the demographic and clinical characteristics of the patients and informants, CDR and CDR-SB scores, cognitive test scores, and clinical diagnoses. The number of endorsed AD8 items by the participant was compared with the number endorsed by the informant with the independently derived measures from the clinical assessment.

Strength of association between participant and informant was measured by the intraclass correlation coefficient. Correlations between participant or informant AD8 scores with clinical measures (MMSE, SBT, CDR, CDR-SB) were determined with Spearman ρ correlation coefficients. Receiver operator characteristic curves and the area under the receiver operator characteristic curve were generated to reflect graphically and quantitatively the ability of the AD8 to discriminate between nondemented patients (CDR 0) and patients with very mild dementia or greater (CDR 0.5). Analyses were repeated to determine discriminative properties of the AD by different demographic characteristics. The sensitivity, specificity, and positive and negative predictive values of the AD8 were calculated.²⁵

RESULTS

SAMPLE CHARACTERISTICS

The participants' mean \pm SD age at time of assessment was 76.8 \pm 8.9 years (range, 43-104 years) with a mean educational attainment of 14.4 \pm 3.1 years (range, 6-29 years); 57% were women. The sample was 88.9% white, 10.8% African American, and 0.3% other. The informants' age at time of assessment was 66.4 \pm 12.9 years (range, 24-101 years) with an educational attainment of 15.1 \pm 3.5 years (range, 2-30 years); 62% were women. The informants' relationships included spouses (57%), children (25%), and others (18%). The AD8 scored by either the participant or informant took less than 3 minutes to complete.

The participants' cognitive status ranged from CDR 0 (46%), CDR 0.5 (31%), and CDR 1 (15%) to CDR 2 or greater (8%). Of those participants with a CDR 0.5 or greater, 74% had a clinical diagnosis of AD, 2% had dementia with Lewy bodies, 2% had frontotemporal dementia, and 23% had uncertain dementia. Depressive symptoms were present in 10% of the sample. The informant's mean AD8 scores were 2.8 \pm 2.9 (range, 0-8). The participant's mean AD8 scores were 1.9 \pm 2.2 (range, 0-8). The mean MMSE score of the sample was 26.0 \pm 4.9 (range, 2-30), and the mean SBT score was 11.1 \pm 4.8 (range 4-25).

AD8 SCORES COMPARED WITH CDR STAGES

Total AD8 scores for the informant and participant were compared with CDR stages (**Table 1**). Those individuals who were rated as CDR 0 had a mean informant AD8 score of 0.64 (range, 0-6) compared with individuals who had at least very mild cognitive change (CDR 0.5 or greater) who had a mean score of 3.49 or greater (range, 0-8). Increasing mean AD8 total scores reflect more severe stages of dementia. Participants with CDR 0 rating their own cognitive abilities had a mean AD8 score of 1.01 (range, 0-7) while participants who had a CDR 0.5 or greater had a mean score of 2.80 or greater (range, 0-8). In contrast to informant AD8 scores, the participants' total AD8 scores did not increase with greater dementia severity. There was adequate agreement between informant ratings of dementia and participant ratings of their own impairments (intraclass correlation coefficient 0.52; 95% confidence interval, 0.41-0.62). Agreement between participant and informant was better in more mildly impaired individuals than for more severely impaired individuals.

CORRELATION OF AD8 TO OTHER MEASURES OF COGNITIVE STATUS

There were significant correlations between assessment variables and AD8 scores (**Table 2**). The informant AD8 scores correlated with the MMSE, SBT, CDR, and CDR-SB. Weaker relationships were noted between informant AD8 scores and the participants' account of memory problems and the clinician's impression of depression. The participant's AD8 scores also correlated with the MMSE, SBT, CDR, and CDR-SB but to a lesser degree than the informant ratings, possibly reflecting the participant underestimating the extent of cognitive problems. The participant's AD8 scores also correlated with subjective complaints of memory problems and the clinician's impression of depression. The AD8 was not predictive of the participants' estimated duration of memory symptoms.

DISCRIMINATIVE ABILITY OF THE AD8

Receiver operator characteristic curves were generated to measure the effectiveness of the AD8 in classifying no dementia vs dementia (dementia prevalence, 54%). The area under the receiver operator characteristic curve for the informant AD8 was 0.89 (95% confidence interval, 0.86-0.93) and for the participant AD8 was 0.74 (95% confidence interval, 0.68-0.79), suggesting good to excellent ability to discriminate between CDR 0 and CDR 0.5 or greater. We next explored the discriminative ability of the participant's AD8 to rate cognitive difficulties by different demographic characteristics (**Table 3**). The AD8 was similarly effective in male vs female participants and in white vs African American participants. The AD8 was able to discriminate nondemented individuals from those with uncertain or very mild dementia (CDR 0.5) slightly better than those with mild to moderate dementia (CDR \geq 1) (area under the receiver operator characteristic curve, 0.77 vs 0.66). One interpretation of the

Table 1. AD8 Scores by CDR Stage and Rater

| CDR | No. | AD8 Score, Mean \pm SD | |
|-----|-----|--------------------------|-----------------|
| | | Informant | Participant |
| 0 | 149 | 0.64 \pm 1.19 | 1.01 \pm 1.52 |
| 0.5 | 102 | 3.49 \pm 2.32 | 2.80 \pm 2.19 |
| 1 | 50 | 6.64 \pm 1.74 | 2.40 \pm 2.51 |
| 2 | 23 | 6.22 \pm 2.66 | 3.00 \pm 2.66 |

Abbreviation: CDR, Clinical Dementia Rating.

finding that participant AD8 scores do not increase with dementia severity (Table 1) is that insight may decrease with increasing dementia severity; therefore, the utility of the AD8 participants rating decreases in more advanced stages of dementia. The AD8 was most effective as a self-rating instrument to age 80 years; after this age, the predictive ability of the AD8 was lower (area under the receiver operator characteristic curve, 0.66, 95% confidence interval, 0.55-0.77).

We next examined the psychometric properties of the AD8 for both participant and informant using different cut-offs (**Table 4**). Using a cut-off score of 2 or greater on the informant AD8 to predict dementia yielded the most desirable combination of sensitivity (84%) and specificity (93%). With a dementia prevalence of 54%, the positive predictive value (the probability that someone with an AD8 score \geq 2 has dementia) was 85%, whereas the negative predictive value (the probability that someone with an AD8 score $<$ 2 is nondemented) was 81%. The participant's self-rating had the best combination of sensitivity (80%) and specificity (59%) using a cut-off score of 1. This cut-off yielded a positive predictive value of 70% and a negative predictive value of 71%. Applying higher cut-offs increased specificity but decreased sensitivity, most likely because more impaired individuals are less likely to rate impairments.

COMMENT

The AD8, although developed as an informant rating, may also serve as a self-rating tool (eg, when an informant is not available) to discriminate older adults without dementia from those with even the mildest forms of dementia. The self-rated AD8 corresponded to gold standards for this study (the CDR and CDR-SB) and to brief global assessments of cognition (MMSE and SBT) and had adequate agreement with the informant's AD8 rating. The participants were able to complete the AD8 within 3 minutes without additional instructions.

One of the great challenges in geriatric care is to identify persons with symptoms of dementia who may have limited capacity to recognize these symptoms and instead often attribute cognitive decline to chronic illness or aging.²⁶ While informant interviews provide a more reliable way to determine cognitive and functional change in dementia patients, informants are not always attendant. Brief office visits such as annual check-ups, often without the presence of informants, may not uncover very mild symptoms of dementia. Dementia screening is not

Table 2. Correlations Between Assessment Variables and AD8 Scores

| Variable | Informant AD8 | | Participant AD8 | |
|--|-----------------|---------|-----------------|---------|
| | Spearman ρ | P Value | Spearman ρ | P Value |
| CDR | .76 | <.001 | .36 | <.001 |
| CDR-SB | .77 | <.001 | .35 | <.001 |
| MMSE | -.53 | <.001 | -.27 | <.001 |
| SBT | .49 | <.001 | .29 | <.001 |
| Participant account of memory problems | .25 | <.001 | .49 | <.001 |
| Participant estimate of duration | .02 | .81 | -.005 | .96 |
| Clinician impression of depression | .13 | .03 | .20 | <.001 |

Abbreviations: CDR, Clinical Dementia Rating; CDR-SB, CDR sum of boxes; MMSE, Mini-Mental State Exam; SBT, Short Blessed Test.

Table 3. Discriminative Properties of the AD8 by Demographic Categories

| AD8 Scores | CDR Comparison | No. | AUC | 95% CI | |
|-------------------------------|----------------|-----|------|--------|-------|
| | | | | Lower | Upper |
| By respondent | | | | | |
| Participants | 0 vs >0 | 319 | 0.74 | 0.68 | 0.79 |
| Informants | 0 vs >0 | 319 | 0.89 | 0.86 | 0.93 |
| By CDR stage | | | | | |
| Participants | 0 vs 0.5 | 246 | 0.77 | 0.71 | 0.83 |
| Participants | 0 vs 1 | 195 | 0.66 | 0.58 | 0.75 |
| Participants | 0 vs 2 | 169 | 0.74 | 0.63 | 0.85 |
| By sex | | | | | |
| Male participants | 0 vs >0 | 139 | 0.74 | 0.66 | 0.82 |
| Female participants | 0 vs >0 | 180 | 0.73 | 0.66 | 0.80 |
| By race | | | | | |
| White participants | 0 vs >0 | 284 | 0.72 | 0.66 | 0.78 |
| African American participants | 0 vs >0 | 34 | 0.85 | 0.72 | 0.97 |
| By age, y | | | | | |
| Participants <75 | 0 vs >0 | 130 | 0.77 | 0.69 | 0.85 |
| Participants 75-80 | 0 vs >0 | 91 | 0.78 | 0.69 | 0.87 |
| Participants \geq 81 | 0 vs >0 | 98 | 0.66 | 0.55 | 0.77 |

Abbreviations: AUC, area under the curve; CDR, Clinical Dementia Rating; CI, confidence interval.

Table 4. Psychometric Properties of the AD8 Using Different Cut-offs

| Cut-off | Sensitivity, % | Specificity, % | PPV, %* | NPV, %* |
|------------------------|----------------|----------------|---------|---------|
| Informant AD8 scores | | | | |
| 1 | 90 | 68 | 77 | 85 |
| 2 | 84 | 93 | 85 | 81 |
| 3 | 76 | 90 | 90 | 76 |
| Participant AD8 scores | | | | |
| 1 | 80 | 59 | 70 | 71 |
| 2 | 62 | 73 | 73 | 62 |
| 3 | 47 | 82 | 76 | 57 |

Abbreviations: NPV, negative predictive value; PPV, positive predictive value.
*Predictive values based on a dementia prevalence of 54%.

commonly done in the primary care setting for a number of reasons, including insufficient time allotted to the patient visit, inadequate reimbursement for cognitive work, and uncertainty about the value of early diagno-

sis.²⁷ An additional problem is the lack of brief sensitive and predictive measures that reliably discriminate healthy older adults from those with mild dementia.

Evaluation of dementia typically consists of objective testing²⁸⁻³⁰ of the patient and, when available, questioning of a reliable informant.^{15,31} Dementia patients are not thought to be reliable reporters of cognitive symptoms because of the unawareness of cognitive deficits (cognitive anosognosia)⁹ leading to discrepancies between self-ratings and the ratings of informants or between self-ratings and objective performance.³² Awareness of deficits may vary greatly across individuals with some patients offering reliable accounts of memory changes and other patients failing to appreciate their decline. In a recent study, 32 control patients and 14 patients with AD were asked to self-estimate memory, attention, behavior, naming, visuospatial ability, limb praxis, mood, and vision. Patients with AD did poorly in estimating all abilities, in particular overestimating memory and visuospatial function. However, control participants also made errors, overestimating limb praxis and vision and underestimating attention.⁹

Although self-rating tools for assessing cognitive function of patients have been developed previously,^{8,32,33} they are not in common use. One such scale, the Memory Functioning Questionnaire,¹¹ is a 64-item scale that has been validated against objective memory measures¹² and has high internal consistency.¹¹ Its length and complexity, however, make it impractical. Patients with mild dementia may be aware of the presence of deficits but not of the severity of the cognitive problems or their consequences.⁸ Denial of cognitive deficits does not correlate with age at dementia onset or duration of illness or education and is negatively correlated with depression.⁷ The more severe the memory impairment, the more likely the presence of denial.^{7,33} Similarly, the utility of the AD8 as a self-reported measure may be greater in individuals with very mild impairment compared with more demented individuals.

However, dementia patients are asked to self-rate a number of physical, psychological, and social symptoms. A recent study assessed physical, psychological, and social health of dementia patients, 75% of whom had MMSE scores lower than 16.³⁴ There was reasonable agreement between patient and informant rating for physical health, but agreement was poor for psychological and social well-being. Dementia patients are also asked to self-rate the presence of depressive symptoms³⁵ and quality of life.³⁶ Most patients are able to complete these assessments and, in the case of quality of life, dementia patients were not only able to rate their own quality of life but were able to give reasonable estimates of the caregiver's rating of quality of life.³⁶ Patients with dementia may have better preserved recognition of mood and functional changes but poorer recognition of memory decline. However, these studies suggest that patients may be able to provide self-ratings with questions that tap into multiple domains such as found in the AD8.

We have previously reported the value of informant vs participant reports of memory problems.^{2,6,13-15,22,31} While informant interviews are still preferable to detect subtle signs of cognitive decline, we provide evidence that patients may be able to offer useful information about their cognitive ability if unaccompanied by an informant. There are several reasons that the AD8 may capture self-reported symptoms of cognitive decline. First, the AD8 questions are neutral in tone and present everyday functional activities in a nonthreatening fashion. Second, individuals are not asked to offer complaints but simply rate whether a change in their ability to complete the tasks has occurred. Last, the AD8 questions do not attribute cause to any change in ability, so it is less likely to provoke anxiety about whether change is due to aging or disease in the respondents. Similar to the findings in other studies of awareness of cognitive deficits,^{7,8,33} the AD8 scores as reported by the participant do not increase with dementia severity and are not associated with estimates of duration of symptoms.

There are limits to this study. The sample is a convenience cohort recruited for participation in a longitudinal study and may not be representative of the general population. Our sample is English-speaking and largely white. Although no difference in predictive power was seen in the African American participants, further investigation of the AD8 in community and other minority samples is needed.

Subjective cognitive complaints are common in older adults, found in up to 88% of individuals over the age 85 years.³⁷ These complaints are often attributed to depression.^{38,39} Depressive symptoms were present in 10% of our sample. Although none of these individuals met DSM-IV criteria for major depression,¹⁸ it is likely that the severity of depression and other emotional factors (eg, anxiety, apathy, abulia) may impact an individual's ability to give reliable self-ratings. However, since the AD8 is used as a screening test, further evaluation of affect and motivational state should enable identification of depressed individuals. It is unclear whether patients who complain of memory problems are necessarily at a higher risk of developing dementia.³⁸ A short scale addressing self-rating of cognitive abilities may be preferable to asking a single question about memory self-perception to assess memory complaints (ie, "Are you having a problem with your memory?").¹² The AD8 is a brief screening tool that may discriminate healthy older adults from those with very mild dementia. The AD8 is administered preferably to an informant. In the absence of an informant, the AD8 can be administered to the patient, and if any of the questions are endorsed, further evaluation is warranted. The AD8 may have applicability as a screening tool in community settings and primary care to assist in the detection of dementia in the older adult.

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