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Validity and reliability of the AD8 informant interview in dementia

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Abstract—*Objective:* To establish the validity, reliability, and discriminative properties of the AD8, a brief informant interview to detect dementia, in a clinic sample. *Methods:* We evaluated 255 patient–informant dyads. We compared the number of endorsed AD8 items with an independently derived Clinical Dementia Rating (CDR) and with performance on neuropsychological tests. Construct and concurrent validity, test–retest, interrater and intermodal reliability, and internal consistency of the AD8 were determined. Receiver operator characteristic curves were used to assess the discriminative properties of the AD8. *Results:* Concurrent validity was strong with AD8 scores correlating with the CDR (r = 0.75, 95% CI 0.63 to 0.88). Construct validity testing showed strong correlation between AD8 scores, CDR domains, and performance on neuropsychological tests. The Cronbach alpha of the AD8 was 0.84 (95% CI 0.80 to 0.87), suggesting excellent internal consistency. The AD8 demonstrated good intrarater reliability and stability (weighted kappa = 0.67, 95% CI 0.59 to 0.75). Both in-person and phone administration showed equal reliability (weighted kappa = 0.65, 95% CI 0.57 to 0.73). Interrater reliability was very good (Intraclass correlation coefficient = 0.80, 95% CI 0.55 to 0.92). The area under the curve was 0.92 (95% CI 0.88 to 0.95), suggesting excellent discrimination between nondemented individuals and those with cognitive impairment regardless of etiology. *Conclusion:* The AD8 is a brief, sensitive measure that validly and reliably differentiates between nondemented and demented individuals. It can be used as a general screening device to detect cognitive change regardless of etiology and with different types of informants.

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We have found informant-based assessments of intraindividual change such as the Clinical Dementia Rating (CDR)[1] to be more sensitive than brief performance-based measures that rely on interindividual norms to detect cognitive change. We used this premise to develop a brief informant interview, the AD8, which distinguished individuals with very mild dementia from those without dementia.[2]

There are inherent problems relying on brief performance-based measures to diagnose dementia. Brief cognitive tests are likely limited in their ability to detect change because baseline testing is often unavailable. Commonly used tests such as the Mini-Mental State Examination (MMSE)[3] show ceiling effects that render them insensitive to early signs of dementia,[4] especially in highly educated individuals, and these tests may not be culturally sensitive.[5,6] Other brief measures such as the Memory Impairment Screen[7] test only memory domains and are therefore less likely to be helpful in detecting nonamnestic forms of dementia such as vascular dementia (VaD),[8] dementia with Lewy bodies (DLB),[9] or frontotemporal dementia (FTD).[10] In addition, individuals with very mild cognitive impairment (MCI)[11] may not meet criteria for dementia, and it is unclear how well these brief measures perform in this group. Longer performance-based measures such as the Cognitive Abilities Screening Instrument[12] have less cultural bias and are less likely to exhibit ceiling effects but require extensive training to administer and generally are too lengthy for use in general practice.

Because the AD8 was developed with a longitudinal research sample, it was important to establish its applicability in community-based, clinical samples. We sought to test how well informants of "real-world" patients would rate the cognitive and functional abilities of patients compared to our gold standard—the CDR. We also assessed the ability of the AD8 to detect nonamnestic forms of dementia and the performance across different informants and demographic characteristics. We conducted measurements of the reliability, validity, and discriminative properties of the AD8.

Methods. *Study participants.* Participants were drawn from a consecutive series of referrals to the Memory Diagnostic Center (MDC), a dementia specialty practice at Washington University School of Medicine with five neurologists, one geriatrician, and six nurse clinicians. Referrals to MDC are made by primary care physicians from the St. Louis metropolitan area and nine Mid-

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Table 1 *AD8 questions asked of informants*

1. Problems with judgment (e.g., falls for scams, bad financial decisions, buys gifts inappropriate for recipients)
2. Reduced interest in hobbies/activities
3. Repeats questions, stories, or statements
4. Trouble learning how to use a tool, appliance, or gadget (e.g., VCR, computer, microwave, remote control)
5. Forgets correct month or year
6. Difficulty handling complicated financial affairs (e.g., balancing checkbook, income taxes, paying bills)
7. Difficulty remembering appointments
8. Consistent problems with thinking and/or memory

The above AD8 questions are asked of an informant. The instructions are given to the informant either in person or over the phone: "Remember, 'Yes, a change' indicates that you think there has been a change in the last several years cause by cognitive (thinking and memory) problems." Items endorsed as "Yes, a change" are summed to yield the total AD8 score.

western states for evaluation of cognitive, behavioral, and mood disorders. Assessments are conducted by one of the six physicians to whom the patient is assigned. Diagnoses range from nondemented individuals (CDR 0) through all levels of dementia severity (CDR 0.5 to 3). When calling for an appointment, the patient is asked to identify an informant to provide additional information on cognitive and functional change. Less than 1% of patients are unable to identify a collateral source. A total of 255 patient–informant dyads agreed to participate in the study. No patient–informant dyad contributed more than one visit to the data set. The Washington University Human Studies Committee approved all procedures.

Administration of the AD8. The AD8 contains eight questions asking the informant to rate change (Yes vs No) in memory, problem-solving abilities, orientation, and daily activities (table 1).[2] The number of Yes answers is totaled to obtain the AD8 score. We examined the reproducibility of the tool across different informants (interobserver reliability), within the same informant at two time points (test–retest reliability), and across different modes of administration to the same informant (intermodal reliability: telephone interview vs paper version). Approximately 1 week before the office visit, the patient–informant dyad was contacted by phone to collect current health information (medications, comorbid disease), family history, depressive features, and activities of daily living. At this time, the dyad was asked to participate in the study. If agreeable, after informed consent, the informant was asked to rate the patient according to eight questions (the AD8)[2] with the nurse reading the questions to the informant and recording the response. Each patient was accompanied by the same informant to the MDC office visit, and at this time, the informant was given a paper version of the AD8 to complete. Approximately 1 week after the clinical visit, the nurse again called the collateral source to readminister the AD8. The informant was first asked a screening question to determine whether he or she had noticed change in the patient's condition since the office visit. If the informant gave an affirmative response, the data were disregarded because of a loss of stability in the feature over time. Each caregiver was interviewed by the nurse clinician assigned to that patient for the previsit and postvisit AD8 to ensure that the AD8 was administered over the phone in the same fashion. Although measuring interobserver reliability was not possible in all cases, in instances where more than one collateral source was available, the AD8 was administered to two individuals at the time of the office visit. The MDC physicians were blinded to the results of all AD8 administrations.

Clinical assessment. The MDC physicians conducted independent semistructured interviews with the patient and a knowledgeable collateral source (usually the spouse or close family member).[13-15] Each patient–caregiver dyad was interviewed by one physician to generate a diagnosis and CDR. The diagnostic criteria for dementia of the Alzheimer type used in this study (impairment in memory and at least one other cognitive domain and interference with daily activities) are consistent with the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (*DSM-IV*), definition[16] and of "probable AD" category in the National Institute of Neurological and Communicative Diseases and-Stroke–Alzheimer's Disease and Related Disorders Association criteria.[17] Wherever possible, published criteria were used for other dementing disorders, including VaD,[8] DLB,[9] and FTD.[10]

The CDR was used to determine the presence or absence of dementia and to stage its severity.[1] The CDR rates cognitive function in each of six categories (memory, orientation, judgment and problem solving, performance in community affairs, home and hobbies, and personal care). A global CDR of 0 indicates no dementia. A CDR of 0.5 represents very mild dementia or, in some cases with minimal impairment, uncertain or questionable dementia. A CDR of 1, 2, or 3 corresponds to mild, moderate, or severe dementia, respectively.[1] The sum of CDR boxes (CDR-SB) provides a quantitative expansion of the CDR ranging from 0 (no impairment) to 18 (maximum impairment).[18] In our sample, the CDR 0.5 rating equates with very mild dementia[19] and is the threshold to distinguish nondemented (CDR 0) from demented (CDR $\geq$ 0.5) status. In other samples, a CDR of 0.5 has been used as the threshold for the diagnosis of MCI.[11] In both cases, the CDR is useful to detect the change in cognitive abilities from a previous level of function and also to assess interference with accustomed activities. Therefore, the CDR was used as the gold standard for cognitive impairment in this study.

Neuropsychological evaluation. A 30-minute test battery was administered to each patient at the time of the office visit. The psychometrician was unaware of the participant's CDR stage and diagnosis. The battery included measures of episodic and working memory: Wechsler Memory Scale (WMS)[20] Logical Memory and the Consortium to Establish a Registry for Alzheimer's Disease 10-item Word List immediate and delayed recall task.[21] Animal Word Fluency[22] and the 15-item Boston Naming Test[23] assessed semantic memory. Three speeded measures addressed psychomotor, visuospatial, and executive abilities: Wechsler Adult Intelligence Scale Digit Symbol,[24] Trailmaking A,[25] and Trailmaking B.[25] Brief global measures included the Mini-Mental State Examination[3] and the Short Blessed Test.[26] Construction was assessed with the Clock Drawing Task.[27] The patients' mood was assessed with nine screening items from the *DSM-IV* depressive features[16] asked independently of the patient and caregiver.

Statistical analysis. All analyses were performed using SAS (Cary, NC). Descriptive statistics were used to report the demographic and clinical characteristics of the patients and informants including age, race, sex, education, CDR, CDR-SB, AD8 scores, neuropsychological test results, and clinical diagnoses.

Concurrent validity was assessed comparing the mean performance between the nondemented and demented groups (CDR 0 vs CDR $\geq$ 0.5). Receiver operator characteristic (ROC) curves and the area under the ROC curve (AUC) 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 (CDR 0.5). Analyses were repeated to determine discriminative properties of the AD8 between nondemented patients (CDR 0) and patients with all stages of dementia (CDR $\geq$ 0.5). The sensitivity, specificity, and positive and negative predictive values of the AD8 were calculated.[28-32] Convergent and discriminative validity was assessed with Spearman correlation coefficients.[28-32] For convergent validity, moderate correlations ($r >$ 0.4) between items in each domain and between similar constructs in CDR or neuropsychological tests were accepted as evidence. For discriminant validity, low correlation ($r <$ 0.3) between items in different domains and between nonsimilar CDR and neuropsychological tests were accepted.

Internal consistency was examined as the proportion of the variability in the responses that is the result of differences in the respondents. Internal consistency was reported as the Cronbach alpha reliability coefficient. Coefficients greater than 0.7 and less than 0.9 were accepted as good measures of internal consistency. Weighted kappa statistics were calculated to assess the percent agreement within raters at two time points (intrarater reliability) and with two modes of administration (intermodal reliability) correcting for chance agreement.[31] Simple agreement (i.e., the proportion of responses in which two observations agree) is strongly influenced by the distribution of positive and negative responses,

as well as the possibility of agreement by chance alone. The kappa coefficient explicitly deals with the situation by examining the proportion of responses in agreement in relation to the proportion of responses that would be expected by chance.[31] We used the scheme reported by Fleiss in assessing agreement.[33] A kappa statistic between 0.55 and 0.75 would be considered good agreement, whereas a kappa statistic greater than 0.76 would be considered excellent.[33] The intraclass correlation coefficient (ICC) was reported to assess the interrater reliability. The ICC is computed from multiple observations of the same variable to evaluate the consistency among the raters rather than absolute agreement.[33]

Results. *Sample characteristics.* The AD8 was administered to 255 patient–informant dyads between October 1, 2003, and September 30, 2004. The patients' mean (± SD) age at time of assessment was 73.3 ± 11.3 years (range 40 to 102 years), with an educational attainment of 13.7 ± 3 years (range 6 to 20 years), and 56% were women. The sample ethnicity consisted of 77% white, 22% African-American, and 1% other. The collateral sources were spouses (53%), children (37%), and other sources such as friends, social workers, case managers, and health aides (10%). The patients' cognitive status ranged from nondemented (CDR 0) through all stages of dementia (CDR ≥ 0.5). CDR scores were available for 250 of the 255 dyads and diagnoses for 241 of the 255 dyads. The mean office visit AD8 score for the sample was 5.2 ± 2.4 (range 0 to 8, skewness −0.646 ± 0.146). The mean MMSE score of the sample was 19.3 ± 7.8 (range 0 to 30, skewness −0.572 ± 0.153), and the mean Short Blessed score was 12.8 ± 8.1 (range 0 to 28, skewness 0.204 ± 0.154). The sample demographics, CDR scores, and diagnoses are shown in table 2. Performances of the sample on neuropsychological tests are shown in table 3. The AD8 administered either in person or over the phone took less than 3 minutes to complete.

Validity studies. Concurrent (criterion) validity is the correlation of the AD8 compared with gold standard measures of dementia presence and severity, the CDR and CDR-SB, to assess the ability of the AD8 to adequately differentiate groups that should be differentiable.[28-32] The previsit, office visit, and postvisit AD8 total scores were highly correlated with both the CDR and CDR-SB (Spearman correlations ranged from 0.71 to 0.78; standard errors ranged from 0.06 to 0.07). Table 3 provides the correlation of the office visit AD8 with all clinical and cognitive measures collected at the time of the MDC office visit.

Construct validity is the correspondence of how well an instrument measures a theorized trait.[31] Table 4 lists the AD8 domains and the corresponding CDR and neuropsychological tests. Demonstration of strong correlations (≥40%) between the individual AD8 items and CDR and neuropsychological tests support convergent validity, suggesting the AD8 item and the corresponding test tap into similar cognitive domains. Conversely, low correlations (≤30%) between AD8 items and CDR and neuropsychological tests suggest there is no relationship.[30-32] Item 1 (problems with judgment) is highly correlated with the CDR judgment and problem-solving domain and with tests of speeded psychomotor, visuospatial, and executive function such as Trailmaking B and Digit Symbol, but is divergent from the memory and orientation CDR domains and tests of semantic (Animal Fluency, Boston Naming) and episodic memory (Logical Memory, Word Lists). Item 3 (repeats questions, statements, or stories) is convergent with the CDR memory domain and the Word List (delayed recall) test and divergent from other CDR domains and neuropsychological tests. These results suggest that Item 1 specifically assesses executive abilities and that Item 3 assesses memory function and not other cognitive domains. Items 2

Table 2 *Demographics, CDR stages, and diagnostic categories of the sample and AD8 discriminative properties*

	n	%	AUC (95% CI)
Age			
<70 y	76	30.4	0.928 (0.87–0.93)
70–80 y	104	41.6	0.919 (0.86–0.97)
>80 y	70	28.0	0.956 (0.89–1.01)
Sex			
Male	109	43.6	0.912 (0.85–0.97)
Female	141	56.4	0.922 (0.88–0.97)
Education			
High school or less	117	48.3	0.907 (0.84–0.97)
>High school	125	51.9	0.911 (0.86–0.96)
Race			
White	194	77.6	0.910 (0.86–0.96)
Nonwhite	56	22.4	0.934 (0.87–0.99)
MMSE score			
>23	85	37.4	0.877 (0.81–0.95)
17–23	68	30.0	0.932 (0.87–0.99)
<17	74	32.6	0.945 (NA)
Collateral sources			
Spouses	135	52.9	0.894 (0.84–0.94)
Children	94	36.9	0.938 (0.88–0.99)
Others	26	10.2	0.917 (0.68–1.14)
CDR			
0 vs non-0	250	100	0.915 (0.88–0.95)
0 vs 0.5	140	56.0	0.847 (0.78–0.92)
0 vs 1	98	39.2	0.978 (0.95–1.00)
0 vs 2	59	23.6	0.998 (0.99–1.00)
0 vs 3	37	14.8	1.00 (NA)
Diagnosis			
No dementia	24	10.0	—
DAT	118	49.0	0.958 (0.93–0.99)
VaD	4	1.7	0.984 (0.94–1.0)
Mixed DAT/VaD	12	5.0	0.981 (0.94–1.0)
DLB/Parkinson dementia	14	4.2	0.844 (0.70–1.0)
FTLD	12	5.0	0.951 (0.87–1.0)
Progressive aphasia	9	3.7	0.910 (0.74–1.0)
Active mood disorder ± memory disorder	8	3.2	0.929 (0.81–1.0)
Uncertain dementia/MCI	25	10.7	0.697 (0.55–0.84)
Other non-DAT dementias	15	6.2	0.874 (0.73–1.0)

CDR = Clinical Dementia Rating; AUC = area under the curve; MMSE = Mini-Mental State Examination; NA = 95% CI could not be calculated; DAT = dementia of the Alzheimer type; VaD = vascular dementia; DLB = dementia with Lewy bodies; FTLD = frontotemporal lobar degeneration; MCI = mild cognitive impairment.

Table 3 *Mean performance on CDR and neuropsychological tests and concurrent validity of the AD8*

Measure/Scale	Mean (SD)	*R*	95% CI
CDR	0.88 (0.69)	0.74	0.63 to 0.88
CDR-SB	4.74 (4.19)	0.78	0.66 to 0.90
MMSE	19.29 (7.79)	−0.41	−0.58 to −0.24
Short Blessed Test	12.78 (8.12)	0.33	0.16 to 0.51
WMS Logical Memory	4.16 (5.86)	−0.38	−0.55 to −0.20
10-Item Word List (immediate recall)	12.28 (5.72)	−0.37	−0.54 to −0.20
10-Item Word List (delayed recall)	2.45 (2.67)	−0.39	−0.57 to −0.22
Animal Fluency	11.47 (6.30)	−0.05	−0.24 to 0.13
15-Item Boston Naming	14.38 (6.06)	−0.02	−0.37 to 0.00
Trailmaking A	69.14 (48.23)	0.32	0.14 to 0.49
Trailmaking B	115.70 (54.02)	0.47	0.31 to 0.64
Digit Symbol	34.14 (16.97)	−0.52	−0.68 to −0.36

For AD8, Clinical Dementia Rating (CDR), Clinical Dementia Rating sum of boxes (CDR-SB), Short Blessed, and Trailmaking tasks, higher scores equal greater impairment. For Mini-Mental State Examination (MMSE), Wechsler Memory Scale (WMS) Logical Memory, Word List recall, Animal Fluency, Boston Naming, and Digit Symbol, lower scores equal greater impairment.

(interest), 5 (orientation), and 6 (finances) are associated with all six CDR domains and most of the neuropsychological measures, suggesting that these three questions explore complex cognitive functions that cross several different domains. The AD8 was poorly correlated ($r < 0.3$) with tests of semantic memory (Animal Fluency or Boston Naming).

Reliability studies. We tested the degree to which the AD8 was free from random error by assessing the internal consistency with the Cronbach alpha.[28,31] This provides an estimate of reliability based on all possible correlations between test items. The Cronbach alpha for the previsit AD8 was 0.76 (95% CI 0.70 to 0.83), that for the office visit AD8 was 0.84 (95% CI 0.80 to 0.87), and that for the postvisit AD8 was 0.86 (95% CI 0.83 to 0.88). The Cronbach alpha of the AD8 at any administration was 0.86 (95% CI 0.82 to 0.91).

Reproducibility was assessed via several methods. Test–retest reliability is the degree to which an instrument yields stable scores over time for the same respondent (Intraobserver reliability). AD8 scores between the previsit and postvisit were compared using weighted kappa statistics.[33] The weighted kappa statistic for the AD8 (n = 255) was 0.67 (95% CI 0.59 to 0.75), supporting good intrarater reliability and stability of AD8 scores over 2 to 3 weeks.

Intermodal reliability was also assessed. In many primary care settings, the informant may not accompany the patient to the clinician's office. It was important to test the reproducibility of the AD8 across different modes of administration. The previsit and postvisit phone administrations were compared with the office visit paper administration using weighted kappa statistics. The weighted kappa statistic (n = 250) comparing previsit to office visit was 0.65 (95% CI 0.57 to 0.73), and that comparing the office visit to the postvisit (n = 250) was 0.68 (95% CI 0.62 to 0.74). This supports that the AD8 can be administered either in person or over the phone with equal reliability.

In instances where more than one collateral source was available (n = 19), the AD8 was administered to two individuals at the time of the office visit. The ICC was used to report the percent agreement between the two raters.[33] Although the sample size was small, there was very good interrater reliability (ICC = 0.82; 95% CI 0.5 to 0.92).

Discriminative ability. Receiver operator characteristic curves were generated to measure the effectiveness of the AD8 obtained at the office visit in classifying CDR 0 (nondemented) vs CDR ≥ 0.5 (demented) for different demographic characteristics, MMSE scores, CDR stages, and clinical diagnoses (table 2). The AD8 was sensitive to the presence of dementia regardless of the age of the patient, educational attainment, sex, or MMSE score. The AD8 performed equally well in white (AUC = 0.91, 95% CI 0.86 to 0.96) and nonwhite patients (AUC = 0.93, 95% CI 0.87 to 0.99). The discriminative power of the AD8 was also excellent regardless of the relationship of the informant. The AUC for spouses was 0.894 (95% CI 0.84 to 0.94; wives = 0.909, husbands = 0.885). The AUC for other collateral sources were not different (children = 0.938, others = 0.917).

For the comparison of CDR 0 vs CDR ≥ 0.5, the AUC was 0.915 (95% CI 0.878 to 0.952), suggesting excellent ability to discriminate between nondemented and demented individuals. The AD8 was also effective in discrimination between nondemented (CDR 0) and the very mildest stages of dementia (CDR 0.5), the latter group being the most challenging discrimination to clinicians. The AUC was 0.847 (95% CI 0.78 to 0.92), suggesting very good discriminative ability with greater detection among more impaired patients (CDR 1 or greater).

The discriminative properties of the AD8 were then examined by etiology. ROC curves were generated comparing nondemented individuals with each dementia subtype. The AD8 was effective in discrimination the presence of dementia in many different types of dementia, including Alzheimer disease (AD), VaD, FTD, DLB, and atypical causes of cognitive decline (table 2). This supports the use of the AD8 as a dementia screening tool regardless of the underlying cause of the cognitive impairment. A number of patients present to clinics with mild impairments in function and subjective complaints of memory that are thought to be due to a mood disorder rather than dementia. The AD8 questions also detected cognitive and functional complaints associated with mood disorders (AUC = 0.929, 95% CI 0.81 to 1.0). As a screening tool, this would trigger a further evaluation for these individuals, which would ultimately allow for discrimination of mood vs memory disorder. The AD8 also showed modest discrimination in those patients with uncertain dementia or MCI (AUC = 0.697, 95% CI 0.55 to 0.84).

Using a cutoff of 2 or greater on the AD8 to predict dementia, the sensitivity of the AD8 in a clinic sample was 92% (95% CI 0.888 to 0.958), and specificity was 46% (95% CI 0.280 to 0.649). With dementia prevalence in the office sample at 89%, the positive predictive value (the probability that someone with an AD8 score ≥ 2 has dementia) was 93% (95% CI 0.899 to 0.965). The negative predictive value was 43% (95% CI 0.256 to 0.611). Using a higher cutoff

Table 4 *Construct validity of the AD8*

AD8 Item	Measures	Convergent	Divergent
Item 1: Judgment	CDR	J/PS	M, O
	Neuroψ	Trails B, Digit Symbol	SBT, Animals, Naming, Logical Memory, Word List (total + recall)
Item 2: Interest	CDR	M, O, J/PS, CA, H/H, PC	
	Neuroψ	Logical Memory, Trails B, Naming, Digit Symbol, Word List (total + recall)	Animal Fluency
Item 3: Repeats	CDR	M	J/PS, CA, H/H, PC
	Neuroψ	Word List (recall)	MMSE, SBT, Logical Memory, Trails A/B, Digit Symbol, Animal Fluency, Naming, Word List (total)
Item 4: Appliances	CDR	M, O, J/PS, CA, H/H	
	Neuroψ	MMSE, Logical Memory, Trails A/B, Digit Symbol, Word List (total + recall)	Animal Fluency, Naming
Item 5: Orientation	CDR	M, O, J/PS, CA, H/H, PC	
	Neuroψ	MMSE, SBT, Logical Memory, Trails A/B, Digit Symbol, Word List (total + recall)	Animal Fluency
Item 6: Finances	CDR	M, O, J/PS, CA, H/H, PC	
	Neuroψ	MMSE, SBT, Logical Memory, Trails A/B, Digit Symbol, Word List (total + recall)	Animal Fluency, Naming
Item 7: Appointments	CDR	M, O, J/PS, CA, H/H	PC
	Neuroψ	SBT, Logical Memory	MMSE, Trails A/B, Digit Symbol, Animal Fluency, Naming, Word List (total + recall)
Item 8: Consistency	CDR	M, O, J/PS, CA, H/H	PC
	Neuroψ	MMSE, SBT, Logical Memory, Trails A/B, Digit Symbol, Word List (total + recall)	Animals, Naming

CDR = Clinical Dementia Rating; J/PS = judgment and problem solving; M = memory; O = orientation; Neuroψ = neuropsychological tests; SBT = Short Blessed Test; CA = community affairs; H/H = home and hobbies; PC = personal care; MMSE = Mini-Mental State Examination.

score of 3 or greater, the AD8 sensitivity decreased slightly to 90% (95% CI 0.862 to 0.940), whereas the specificity increased to 68% (95% CI 0.506 to 0.852). The positive predictive value increased to 96% (95% CI 0.929 to 0.985), and the negative predictive value increased to 46% (95% CI 0.311 to 0.616).

Discussion. The AD8 is a brief informant-based measure that validly and reliably differentiates nondemented from demented individuals and is sensitive to the earliest signs of cognitive change as reported by an informant. The AD8 is highly correlated with our gold standard, the CDR and CDR-SB, as well as performance on objective measures of memory, visuospatial skills, attention, and executive function. The AD8 took the collateral sources less than 3 minutes to complete and can be reliably administered either in person or over the phone. The reliability and validity of a brief informant interview such as the AD8 suggests that dementia may be detected at the earliest stages by placing emphasis on intraindividual, rather than interindividual, comparisons. Deviation from the patient's baseline and accustomed activities may not be readily assessed by comparison with a scale determined on the basis of group norms.[34]

A number of brief screening measures such as the MMSE,[3] Short Blessed Test,[26] Clock Drawing Task,[27] and Mini-cog[35] are already available, but these performance-based measures may not be able to detect or quantify change from previous levels of function, particularly in very high-functioning individuals. These same measures may cloud the presence of dementia in individuals with poorer lifelong abilities. Further, many cognitive tests are culturally insensitive and may underestimate the abilities of African-American and other minority groups.[36] There is also little available data about how these brief measures perform in non-AD dementias such as DLB, VaD, and FTD. We have demonstrated that the AD8 performs well across differing ages,

races, education levels, sexes, and MMSE scores. The AD8 also performs well for many forms of dementia and cognitive impairment, although sample sizes were small compared with AD. Although a small proportion of nondemented individuals may initially be counted as demented during screening, further evaluation should exclude these individuals. Even though the AD8 does not correlate with tests of semantic knowledge, there was excellent discriminative power for progressive aphasias, suggesting that the AD8 questions were able to detect functional change as reported by an informant that may serve as a proxy for the patient's cognitive status.

In comparison to performance-based measures, informant-based assessments provide an opportunity for the clinician to assess change from the patients' previous level of function and determine interference with the patient's accustomed functioning in daily tasks, eliminating the need for a premorbid evaluation.[13-15,37] The main limitation of these approaches, however, is the time required to complete an in-depth interview for the CDR or the Informant Questionnaire on Cognitive Decline in the Elderly.[38] Another potential drawback is that knowledgeable informants may not be readily available or accompany the patient to the office visit. We have demonstrated that the AD8 performs equally well as a telephone interview as it does as an in-person interview. In addition, the AD8 performs well across a spectrum of informants. Applying the AD8 to a population with a lower rate of dementia, such as a community medical clinic, is still needed to estimate its utility in a wider population.

In the initial development of the AD8, the sample consisted of volunteers recruited from a longitudinal study of memory and aging, and as with any volunteer sample, selection biases limited generalization of the results. Dementia of the Alzheimer type was the predominant dementia diagnosis in that setting. The sample was largely white, so it was unknown whether these results generalized to other ethnicities. In establishing the validity and reliability of the AD8, we wanted to test how the AD8 would perform in a "real-world" clinic setting with patients residing in the community. Although the sample for this study was not population based, it represents a community clinic referral pattern with sample characteristics similar to US census reports for the St. Louis metropolitan area. The mixture of patients in this sample had a greater diversity of sex and race; included multiple medical comorbidities; had a combination of cognitive, behavioral, and affective disorders; and had collateral sources that varied in terms of relationship and exposure to the patients. In this setting, the AD8 validly and reliably performed as well as the longer semistructured interview used to derive the CDR, and with a 30-minute neuropsychological battery in detecting cognitive change. We believe that the AD8 is an instrument that would be helpful in the primary care and community practice setting to screen older adults for signs of a dementing illness. In conjunction with a brief cognitive assessment, the use of the AD8 could improve diagnostic accuracy in general practice and may be applicable for dementia screening in clinical trials, community surveys, and epidemiologic studies.

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