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Screening for Dementia in Community-based Memory Clinics

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ABSTRACT

Problem: Dementia is a significant public health problem that is underrecognized in primary care settings. This study examined the usefulness of 3 brief screening tests in detecting dementia and mild cognitive impairment (MCI) in persons seeking consultation for memory complaints within a network of memory diagnostic clinics in Wisconsin.

Methods: This prospective study of consecutive referrals for memory diagnostic evaluation analyzed data for 364 patients ≥50 years. Scores on 3 cognitive screening measures—the Mini-Mental State Examination (MMSE), Clock Drawing, and Animal Naming—were compared to clinical diagnosis of normal cognitive aging, MCI, or dementia.

Results: Using the standard cut score of <24, the MMSE identified only 60% of persons diagnosed with dementia. By contrast, using a recommended cut score of <14 words per minute, Animal Naming identified 85% of persons with dementia with a relatively low (12%) false positive rate. Clock Drawing was intermediate to the other 2 measures in screening effectiveness.

Conclusions: Animal Naming was moderately to highly effective in identifying dementia. The naming procedure is easy to administer and may have value as a brief initial dementia screen in busy practice settings. More demanding cognitive measures may be needed to improve screening accuracy for MCI.

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INTRODUCTION

Alzheimer's disease (AD) and other dementing illnesses pose a significant public health and economic problem in Wisconsin that is projected to increase in coming decades. According to estimates compiled in 2004 by the Wisconsin Department of Health and Family Services, 1 out of every 6 Wisconsin residents ≥65 years suffers from dementia.[1] Of the more than 18,000 persons currently living in Wisconsin skilled nursing facilities, 52% have AD or other dementias; of these, 54% are supported by state Medicaid funds. In 2000, the potential cost savings to Medicaid by slowing disease progression and delaying nursing home entry by 1 year for 100 persons was $3.4 million, illustrating the importance of early recognition and treatment.[2]

Although new therapies for AD slow the progression of the disease by several months and may reduce the risk of institutionalization,[3-4] recent studies continue to show that 50% or more cases of mild dementia go undetected by primary care physicians.[5-7] The failure to identify persons with dementia effectively denies patients and families access to treatments as well as the education and support needed to negotiate this illness.

The Wisconsin Alzheimer's Institute (WAI), a center at the University of Wisconsin-Madison School of Medicine and Public Health, has as a primary mission to improve knowledge and skills among Wisconsin health care professionals in diagnosing and treating dementia. Beginning in 1998, a network of 26 WAI-affiliated dementia diagnostic clinics has been established in locations throughout the state, and, to date, an estimated 10,000 individuals and their families have been served by these clinics. The clinic network has also provided a mechanism to perform collaborative research, including a project to evaluate the effectiveness of brief cognitive screening measures suitable for detecting dementia and other cognitive deficits within busy clinical practices.

Among the many cognitive screening instruments available, the best known and most widely used is the Mini-Mental State Examination (MMSE).[8] The MMSE has fair-to-good sensitivity and specificity for detection of moderate dementia,[3] but it is less sensitive to dementia in early stages and to mild cognitive impairment (MCI), which often progresses to dementia.[9,10] Many physicians also find the 5-10 minutes required to administer this exam excessive for routine practice.[10]

Two briefer procedures that have shown some promise as cognitive screening tools are Clock Drawing and verbal fluency. Clock Drawing, which takes 1-2 minutes to administer, differentiates normal aging from clearly diagnosed dementia with a high degree of accuracy.[11] Verbal fluency measures, which generally require only 60 seconds, have also been shown to differentiate normal aging and dementia, with category fluency (e.g., rapid naming of animals, fruits, or supermarket items) being particularly sensitive to the semantic memory deficits of AD. Animal Naming, the most commonly used category fluency measure, effectively distinguished normal controls and persons with mild AD,[12] cognitive impairment without dementia,[13] and MCI.[14] However, the usefulness of verbal fluency measures as cognitive screening tools outside of research settings has yet to be established.

The present study compared the utility of Animal Naming and Clock Drawing to the MMSE in detecting dementia and MCI, based on data from the WAI-affiliated network of community-based memory clinics.

METHODS

Subjects

The sample for this study consisted of consecutive patients seen at 16 of the WAI-affiliated memory diagnostic clinics between May and October 2003. Because no individual identifying information was forwarded to WAI, the informed consent requirement was waived by the Institutional Review Board. This study's analyses focused on persons ≥50 years who were diagnosed with either normal cognitive function for age, MCI, or dementia (n=364).

Cognitive Screening

In addition to routine neuropsychological testing at each clinic, each study participant was administered 3 cognitive screening instruments: Animal Naming, Clock Drawing, and the MMSE. For Animal Naming, participants were asked to name as many animals as possible in 60 seconds; the total score was the number of animals, excluding errors of intrusion or perseveration. Clock Drawing was administered in free-hand format (i.e., without a pre-drawn circle), with patients instructed to draw the face of a clock, fill in the numbers, and set the hands to "10 minutes after 11:00"; drawings were scored by a psychometrist blind to clinical diagnosis using a 10-point scale,[15] with high scores indicating better performance. The MMSE was administered and scored according to the original guidelines of Folstein,[8] except that only serial subtractions were credited for the attention and calculation section, and the words "cat," "ball," and "paper" were used as registration and recall items.

Diagnostic Procedures

Physicians used DSM-IV criteria[16] in assigning diagnoses, supplemented with research diagnostic criteria for MCI, Lewy body dementia, and frontal lobe dementia.[9,17,18] To estimate dementia severity, physicians also assigned a Clinical Dementia Rating[19] (CDR) (0=no impairment, 0.5, 1, 2, and 3=very mild, mild, moderate, and severe impairment, respectively), representing 6 areas of everyday function, based on the interview of the patient and collateral informants. Diagnosis of MCI, which requires quantitative evidence of mild impairment in memory or other cognitive skills,[9] involved neuropsychological testing separate from the 3 screening measures reported here. Neuropsychological tests varied with clinical need, but included, at a minimum, the Cognistat neurobehavioral status examination.[20] Prior to the study onset, physicians and staff of the memory diagnostic clinics attended a 2-day training session covering administration and scoring of the cognitive test instruments as well as detailed review of the spectrum of dementing disorders and research diagnostic criteria for each.

Statistical Analyses

Mean scores on demographic variables, CDR ratings, and the cognitive screening instruments were compared for diagnostic groups by analysis of covariance (ANCOVA), with Tukey HSD for post-hoc comparisons. The accuracy of each cognitive screening measure was examined by computing the percentages of hits and misses of various types relative to clinical diagnosis. Sensitivity and specificity were also calculated. The standard cut score of <24 was used for the MMSE,[3,8] and for Animal Naming, a cut score of <14 was used, as recommended by Monsch et al[12] for detection of mild dementia. Because no standard cut score had been established for the Clock Drawing scoring system that we used, an optimal cut score (<8) for differentiating normal and demented groups was identified by examination of the area under the receiver operating characteristic curve.

Table 1. Sample Characteristics and Cognitive Screening Scores

	Normal	MCI	DAT	Other Dementia*
Number of patients	34	69	140	121
Number of women (%)	27 (79)	41 (59)	106 (76)	82 (68)
Age (years)	70.3 ± 9.7	78.3 ± 6.7†	81.3 ± 7.2†	79.0 ± 7.2†
Education (years)	14.7 ± 2.7	13.3 ± 3.0	12.3 ± 3.6†	11.9 ± 2.9†
CDR	0.1 ± 0.2	0.4 ± 0.2†	1.2 ± 0.6†	1.2 ± 0.6†
Animal Naming score	19.4 ± 5.4	13.9 ± 4.2†	9.3 ± 4.5†	9.3 ± 4.0†
Clock Drawing score	8.8 + 1.3	8.4 + 1.5	5.4 +2.5†	5.7 + 2.7†
MMSE score	28.9 ± 1.4	27.3 ±1.9	21.6 ± 4.4†	21.2 ± 5.3†

MCI=mild cognitive impairment; DAT=dementia of the alzheimer type; CDR=clinical dementia rating; MMSE=mini mental state examination. Values are expressed as mean ± SD unless otherwise indicated. Maximum scores=30 and 10 for the MMSE and Clock Drawing, respectively; CDR range=0 to 3.
*Vascular dementia (n=40), mixed dementia (n=35), Lewy body dementia (n=21), frontal lobe dementia (n=14), and other dementias (n=11).
†Differed significantly from the normal group (P<.05).

RESULTS

Table 1 shows demographic characteristics, CDR ratings, and mean cognitive screen scores for the diagnostic groups. As would be expected, normal participants and those with MCI averaged lower CDR scores (i.e., less functional impairment) than the dementia groups (F[3360]=20.99, P<.001); however, CDR ratings also indicate that severity of dementia was generally mild.

In ANCOVAs comparing diagnostic groups on the cognitive screening measures with age and education covaried, diagnostic group effects were highly significant (Animal Naming, F[3351]=38.9; Clock Drawing, F[3355]=26.5; MMSE, F[3351]=38.5, all P<.001), and for each screening measure, effect sizes were substantially larger for the diagnostic group variable than for age or education (e.g., for Animal Naming, partial eta squared = .248, .068, and .038, for diagnostic group, age, and education, respectively). Because of this result, and to facilitate application of findings to clinical settings, scores on the cognitive screens were not adjusted for age and education in examining the accuracy of the screening measures relative to clinical diagnosis.

Table 2 presents percentages of participants in each diagnostic group who scored below or above recommended cutoffs on each cognitive screening measure. At the recommended cut score of <14, Animal Naming distinguished both DAT and other dementia from normal cognitive aging with good sensitivity (85%) and specificity (88%). By contrast, when the standard cut score of <24 was used for the MMSE, sensitivity fell below clinically useful levels (60% for both DAT and other dementia). Clock Drawing was equal to Animal Naming in specificity (88%), but detected a smaller percentage of persons with DAT or other dementia (75% and 68%, respectively).

DISCUSSION

The memory clinics that provided the data for this study represent an approach to improving detection of dementia and milder forms of cognitive impairment at the interface of primary care. The clientele was a high priority group for cognitive evaluation (i.e., all presented with complaints of cognitive decline by self-report or by an informant),[3] and CDR scores suggest that cognitive impairment was detected at early stages, when pharmacologic treatment and psychosocial interventions would be expected to be of greatest benefit. The involvement of a diverse group of Wisconsin health care professionals demonstrates how an academic medical program, working in partnership with community-based physicians, hospitals, and clinics, can increase availability and quality of dementia-related services on a statewide basis, while also providing a mechanism for rapidly collecting clinical data bearing on important public health issues.

We found that Animal Naming may be useful as a very brief initial screen for dementia and milder degrees of cognitive impairment, to be followed in cases of a positive result by more detailed cognitive assessment tailored to the clinical presentation and other diagnostic procedures. Our findings suggest that a cut score of <14 items may aid in identifying dementia in individuals who have a high school education or more, and for whom there is a clinical basis for concern about cognitive change. Because studies of dementia diagnosis in primary care continue to show that a high percentage of mild dementia cases go undetected,[4-6] it will be important to determine if a very brief screen such as Animal Naming could enhance identification of dementia in such settings.

The MMSE, using the standard cut score of <24, was not sufficiently sensitive to be useful as a screening tool

Table 2. Diagnostic Accuracy of Cognitive Screens Using Recommended Cut Scores

Mini-Mental State Examination		
	Percent of Participants	
Diagnostic Group	Abnormal (<24)	Normal (>24)
Normal cognition	0	100
MCI	1	99
DAT	60	40
Other dementia	60	40
Clock Drawing		
	Percent of Participants	
Diagnostic Group	Abnormal (<8)	Normal (>8)
Normal cognition	12	88
MCI	20	80
DAT	75	25
Other dementia	68	32
Animal Naming		
	Percent of Participants	
Diagnostic Group	Abnormal (<14)	Normal (>14)
Normal cognition	12	88
MCI	54	46
DAT	85	15
Other dementia	85	15

MCI=Mild Cognitive Impairment; DAT=Dementia of the Alzheimer type.

for detecting dementia. Although post hoc analyses indicated that a higher cut score (<28) would have yielded better differentiation in our sample, such a high cut score would likely lead to frequent false positive errors in a general patient population.

On Animal Naming, <14 items proved an effective cut score for detecting dementia of varying types in our sample, which concurs with the results of 2 previous studies that also enrolled relatively well-educated patients.[12,13] For individuals with very limited education, a lower cut score may be needed. However, in our study, there were too few cognitively normal participants to provide an adequate reference group for deriving education adjustments.

Clock Drawing occupied an intermediate position to the MMSE and Animal Naming with respect to diagnostic accuracy, but this result must be viewed with caution, given the absence of a previously established cut score associated with the scoring system that we used. Other administration or scoring methods for Clock Drawing may have resulted in greater sensitivity to dementia.

As expected from previous research,[14,21,22] these brief screening instruments were less effective in identifying persons with mild cognitive deficits (i.e., MCI) as opposed to dementia. Exploratory analyses showed that with a higher cut score (<17), Animal Naming showed fair sensitivity and specificity for distinguishing MCI from normal cognition (76% of normals and 78% of MCI patients correctly classified). However, others have reported optimal cut scores as low as 1513 and as high as 2014 for this purpose, and to significantly improve diagnostic accuracy for MCI, a test of learning and recall (e.g., word list learning) is likely to be needed.[14]

Physicians in this study were not blind to the results of the cognitive screening. However, since the screening results indicate only the presence or absence of cognitive impairment, we doubt that they affected specific diagnostic decisions that were based on history, more extensive neuropsychological testing, and other tests. Also, to the extent that circularity bias may have been present, it would not be expected to differentially affect outcomes for the 3 screening measures. A second limitation concerns the high base rate of cognitive impairment within our sample who presented to the memory clinics with complaints of cognitive impairment. Our study group is not representative of the general elderly population, and instead should be considered similar to patients presenting to their doctor with self-reported or family-reported memory complaints. Screening of this selected group would be expected to inflate the predictive value of a positive screening outcome and reduce the predictive value of a negative screening outcome relative to what may be found in primary care settings in general or in the community, where base rates of cognitive impairment are lower.

CONCLUSIONS

Our findings suggest that the MMSE, using the customary cut score of <24, may be ineffective in identifying persons needing further evaluation for complaints of memory impairment. Both Clock Drawing and Animal Naming may be more useful as office screening instruments, but neither screen provides information that can be used diagnostically to determine the cause of memory complaints. The diagnosis of dementing illness requires additional testing and knowledgeable clinicians, but without reliable screening measures, there is no way to know who to evaluate.

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