The Mini-Cog as a Screen for Dementia: Validation in a Population-Based Sample

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OBJECTIVES: To test the Mini-Cog, a brief cognitive screening test, in an epidemiological study of dementia in older Americans.

DESIGN: A population-based post hoc examination of the sensitivity and specificity of the Mini-Cog for detecting dementia in an existing data set.

SETTING: The Monongahela Valley in Western Pennsylvania.

PARTICIPANTS: A random sample of 1,119 older adults enrolled in the Monongahela Valley Independent Elders Survey (MoVIES).

MEASUREMENTS: The effectiveness of the Mini-Cog in detecting independently diagnosed dementia was compared with that of the Mini-Mental State Examination (MMSE) and a standardized neuropsychological battery.

RESULTS: The Mini-Cog, scored by an algorithm as "possibly impaired" or "probably normal," and the MMSE, at a cutpoint of 25, had similar sensitivity (76% vs 79%) and specificity (89% vs 88%) for dementia, comparable with that achieved using a conventional neuropsychological battery (75% sensitivity, 90% specificity).

CONCLUSION: When applied post hoc to an existing population, the Mini-Cog was as effective in detecting dementia as longer screening and assessment instruments. Its brevity is a distinct advantage when the goal is to improve identification of older adults in a population who may be cognitively impaired. Prior evidence of good performance in a multiethnic community-based sample further supports its validity in the ethnolinguistically diverse populations of the United States in which widely used cognitive screens often fail. **J Am Geriatr Soc 51:1451–1454, 2003.**

Key words: MMSE; MoVIES; epidemiology; brief dementia screens

With the recent availability of useful therapies and strong evidence that dementia is unrecognized in 40% to 75% of patients in primary care,[1–6] the development of rapid, easy-to-use dementia-detection systems has become an international priority for improving care of patients with this prevalent neuropsychiatric disorder of late life.[7] Although many primary care physicians endorse screening, practicing physicians do not commonly perform it and often consider it to be too time-consuming[8,9] or unhelpful.[10] Critical properties of dementia-screening tools proposed for broad application in primary care therefore include rapid administration, simple scoring, good balance between dementia sensitivity and specificity, patient acceptance, and superiority to spontaneous recognition of dementia by patients' primary physicians. Additional important features include minimal bias due to factors extraneous to dementia such as educational and ethnolinguistic differences, screening efficacy comparable with established procedures, and efficiency in epidemiological and clinical applications. A number of brief cognitive screens have been developed, and their known performance characteristics have recently been reviewed.[11] Limitations in published studies of many short screens are the absence of data about their performance in comparison with widely accepted procedures (such as the Mini-Mental State Examination (MMSE)) and in epidemiological samples, in which the relatively low rates of dementia encountered in the general older adult population challenge test effectiveness. Therefore, prospective testing of new dementia screening instruments in representative samples is the most desirable approach to establishing their validity and utility but is prohibitively labor-intensive during the early stages of test development. The use of existing data sets for this purpose allows initial evaluation of a proposed procedure before full-scale prospective testing is feasible or justified.

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Supported by grants from the National Institute on Aging (AG-05136, Drs. Borson and Scanlan; AG-7562, Drs. Ganguli and Chen). Abstract presented in part at the annual meeting of the American Association for Geriatric Psychiatry, February 2001.

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0002-8614/03/$15.00

The Mini-Cog, which combines two simple cognitive tasks (three-item word memory and clock drawing) with an empirical algorithm for scoring,[12,13] was developed in a community sample that overrepresented dementia cases, persons of low education and nonwhite ethnicity, and non-English-speakers. In that group, the Mini-Cog appears to satisfy most standards for brief cognitive screens, achieving or exceeding the performance of conventional screening methods and greatly improving on spontaneous recognition rates of cognitive impairment by primary doctors even when dementia is in a mild or subclinical stage.[14] To meet the more stringent criterion for potential effectiveness as a dementia screen in the general geriatric population, the Mini-Cog must perform as well as standard tests in a mainstream epidemiological sample with low rates of prevalent dementia. Data from an age-stratified random sample of elderly residents from the Monongahela Valley Independent Elders Survey (MoVIES)[15] provided a unique opportunity to examine the Mini-Cog in a realistic, if post hoc, "field test" setting. Rates of prevalent dementia of at least mild severity have been estimated at 6% to 7%, using conservative criteria empirically defined for this sample of adults aged 65 and older.[16] The authors hypothesized that the Mini-Cog would perform as well as or better than the well-known MMSE and the longer, more-complex diagnostic battery combining a number of established neurocognitive testing procedures well described in the initial MoVIES report.[16]

METHODS

Study Sample

The validation sample for this study was an age-stratified random sample drawn from a population of more than 17,000 older adults in 23 communities of the mid-Monongahela Valley of Southwestern Pennsylvania (the MoVIES sample, initiated in the early 1990s).[15] Participants were English speakers aged 65 and older, with at least 6 years of formal education, living in the community. The final random sample of 1,357 subjects all underwent the screening interview, including cognitive testing, yielding adequate data on 1,179 subjects. Seventy-six (6.4%) met *Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised* (DSM-III-R)[16] and National Institute of Neurological and Communicative Diseases and Stroke/Alzheimer's Disease and Related Disorders Association[17] criteria for dementia using a field modification of the Consortium to Establish a Registry for Alzheimer's Disease (CERAD) assessment protocol,[18] and all scored 1 or greater on the Clinical Dementia Rating (CDR) scale,[19] a well-accepted dementia-staging system. All nondemented subjects scored 0; very mild, questionable, or uncertain cases (CDR = 0.5) were excluded from this analysis. All data were derived from the initial wave of testing. The mean MMSE score $\pm$ standard deviation was 21.3 ± 5.8 for demented subjects and 27.8 ± 1.9 for nondemented subjects. Mean age of subjects was 73.1 ± 6.0. and median education was 12 years; 96.6% were white and 54.6% were women.

Measures

The components of the Mini-Cog, including three-item recall and clock drawing, were combined to yield a dementia screen score for each subject, using the algorithm developed on the initial Seattle sample.[13] Because the Seattle clock test (derived from the CERAD protocol) differed from MoVIES', the two systems were compared in a series of 80 clocks drawn by Seattle subjects to establish comparable performance scores. One expert rater blind to other subject data scored all 80 clocks using each system (see[20]). Scores of 6 to 8 on the MoVIES clock test[15] were determined to correspond with a Seattle score of 0 (normal), and MoVIES scores of 1 to 5 corresponded with Seattle scores of 1 to 3 (abnormal) for use in the Mini-Cog scoring algorithm.

RESULTS

In this sample, the Mini-Cog was less sensitive and specific (76% and 89%) than in the Seattle development sample (99%, 93%),[3] as expected based on differing rates of dementia in the two groups. The same was true for the MMSE at the generally applied cutoff of 24; its sensitivity and specificity in the Seattle sample were 92% and 92%, respectively, but in the MoVIES sample, sensitivity and specificity were 71% and 94%. Using this cutoff, the MMSE had lower sensitivity (71%) than the Mini-Cog (76%) but higher specificity (94% vs 89%) (Table 1). When the MMSE cutoff was raised to 25, the Mini-Cog and

Table 1. Sensitivity, Specificity, and Administration Time of Dementia Screens (N = 1,119)

Dementia Screen	Sensitivity (%)	Specificity (%)	Predicted Test Time*
Mini-Cog	76	89	2–4 minutes
3-Item Recall	54	96	2 minutes
Clock Drawing Test	59	90	1–2 minutes
Mini-Mental State Examination			5–12 minutes
23/24 cutpoint	71	94	
24/25 cutpoint	79	88	
Monongahela Valley Independent Elders Survey neurocognitive battery	75	90	$\geq$30 minutes

* Test time established in a different sample.[12]

MMSE had similar sensitivity (76% vs 79%) and specificity (89% vs 88%) in the MoVIES sample, and both were as effective as a much longer standardized neuropsychological battery (75% sensitivity, 90% specificity).

DISCUSSION

Previous work in the heterogeneous Seattle sample, with much higher proportions of demented individuals and a different educational and ethnocultural composition, found the Mini-Cog superior to the MMSE in detecting dementia and much less confounded by factors unrelated to dementia status.[12] The somewhat poorer performance of the Mini-Cog and the MMSE in the population-based MoVIES sample than in the Seattle sample is expected because of the much lower prevalence of dementia in MoVIES. This validation study was conducted not to demonstrate superiority of the Mini-Cog over the MMSE or other procedures in detecting dementia, but because equivalent screening efficacy would imply that the Mini-Cog might be more effective in actual use precisely because it is briefer and more easily administered. Strikingly, three procedures differing markedly in administration time (the Mini-Cog, the MMSE, and a neurocognitive battery) performed with similar sensitivities and specificities. This illustrates the capacity of short tests to overcome the time limitations that are encountered in primary care practices and cited by generalists as the principal reason they avoid dementia screening.[11]

All three approaches to dementia detection were less sensitive than specific in this sample. In general, improvement in sensitivity is achieved at a cost to specificity. In primary care, where dementia prevalence is relatively low (as in MoVIES), higher specificity may be preferable to higher sensitivity, because a positive screening result might press the physician to pursue a costly dementia evaluation as much for unimpaired false positives as for patients who are truly demented.

Limitations of this study include two uncontrolled sources of potential error inherent in the design, including the retrospective examination of the Mini-Cog in the MoVIES sample and the need for translation between clock drawing systems to apply its scoring algorithm. Several previous studies[20–24] have demonstrated that clock tests differ not only in style of administration and scoring but also in sensitivity to executive dysfunction and capacity to discriminate demented from nondemented individuals. The Seattle clock test performed nearly as well as the best research instrument examined,[20] but the MoVIES clock test was less accurate. Therefore, the Mini-Cog might have performed still better in the MoVIES sample had it been possible to use the unmodified Seattle version.

An additional limitation of this study was its reliance on DSM-III-R diagnostic criteria for dementia, current when the initial waves of MoVIES data were collected. Unlike DSM-IV, DSM-III-R did not recognize executive dysfunction as a defining feature of dementia, and the neurocognitive battery used as part of the diagnostic paradigm contained no independent measure of this complex dimension of cognition. A clock-drawing task was included in the Mini-Cog explicitly to capture cognitive abilities more complex than short-term verbal memory. Using the original clock drawing task (in the Seattle study, which employed DSM-IV criteria for dementia), the Mini-Cog was in fact more sensitive to dementia (99%) than was the MMSE (91%), with essentially identical specificity. Whether this superiority is due to greater sensitivity to executive dysfunction remains to be assessed in replication studies.

Population-based approaches to chronic diseases depend on proactive case finding to develop cost-effective, targeted healthcare delivery systems. This conceptual framework is well suited to addressing the current epidemic of dementing disease that has accompanied increasing population longevity. Studies of depression have shown how public health concepts of population-based care can be applied to mental disorders.[25] Brief depression screens have been shown to be acceptable in comparison with longer ones,[26] and previous work comparing cognitive screening tests of different lengths and composition supports a similar conclusion for dementia (reviewed[11,27]). The data reported here show that the Mini-Cog appears to capture nearly all of the MMSE's dementia-screening power in a population-based sample, suggesting that the Mini-Cog may be a practical and effective tool for screening large populations at risk, including older adults in primary care, for whom early detection can facilitate timely intervention with patients and families. Prospective tests of its ability to improve detection of dementia in primary care practice now appear to be warranted.

ACKNOWLEDGMENTS

The authors thank Sherry Neher for expert assistance in manuscript preparation.

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