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Improving identification of cognitive impairment in primary care

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SUMMARY

Objectives To compare the relative level and predictors of accuracy of a brief cognitive screen, the Mini-Cog, with spontaneous detection of cognitive impairment by subjects' primary care physicians.
Participants A heterogeneous community sample ($n = 371$) of predominantly ethnic minority elderly assessed by standardized research protocol, 231 of whom met criteria for dementia or mild cognitive impairment (MCI).
Results The Mini-Cog detected cognitively impaired subjects much more effectively than did subject's own physicians ($p < 0.0001$), correctly classifying 83% of the sample and 84% of cognitively impaired subjects. Physicians correctly classified 59% of all subjects but identified only 41% of cognitively impaired subjects. The Mini-Cog's advantage over physicians was greatest when impairment was mildest (screen *vs* physician recognition at CDR 0.5, 58% *vs* 6%; at CDR 1, 92% *vs* 41%). Additional subject variables associated with missed detection by physicians were non-Alzheimer type dementia and low education, low literacy, and non-English speaking, factors that had little or no effect on the performance of the Mini-Cog. Ethnic differences, also observed for physician recognition, were not significant in final regression equations. The number and recency of primary care visits, and duration of the primary care relationship, were not associated with physicians' recognition of cognitive impairment.
Conclusion This study demonstrates that recognition of cognitive impairment by primary care physicians is adversely influenced by important patient and disease characteristics. Results also show that use of the Mini-Cog would improve recognition of cognitive impairment in primary care, particularly in milder stages and in older adults subject to disparities in health care quality due to sociodemographic factors. Copyright © 2006 John Wiley & Sons, Ltd.

KEY WORDS — dementia screening; ethnic minority; mild cognitive impairment; literacy; language; health care disparity

INTRODUCTION

Cognitive impairment is widely known to be under-recognized and under-treated in primary care settings, with rates of non-recognition ranging from 50–75% depending on setting (Callahan *et al.*, 1995; Boise *et at.*, 1999). Recognition is often delayed until a behavioral crisis has occurred, and physicians rely on families to bring their attention to a cognitive problem (Boise *et al.*, 2004). Physicians report several obstacles preventing timely and accurate identification of cognitive decline in their patients, including lack of familiarity with early symptoms, lack of time and available resources, perceived complexity and lack of knowledge regarding effective use of available screening methods (Boise *et al.*, 1999). The Mini-Cog, a brief, simple screening tool, was developed with the explicit aim of improving dementia detection in primary care settings. The Mini-Cog has been validated in both mainstream epidemiological samples (Borson *et al.*, 2003) and in a multi-ethnic community sample (Borson *et al.*, 2000; Scanlan and Borson, 2001; Borson *et al.*, 2005). The current study reports

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on the rates and predictors of spontaneous detection of cognitive impairment by primary care physicians treating the multi-ethnic subjects in the latter validation sample, in comparison with detection by the Mini-Cog.

METHODS

Subjects and assessments

Five hundred and eighty four elderly community volunteers were enrolled in a multi-ethnic registry of the University of Washington Alzheimer Disease Research Center Satellite, designed to over-represent under-served ethnic minorities particularly representative of the Pacific Northwest population. The sample included 48% Asian Americans, 22% African Americans, 17% Hispanic/Latinos, 7% White non-Hispanic, and 6% Native Americans/other. Subjects were recruited by community screening, referrals from social services agencies, and other outreach methods. None were referred by their primary care physicians; medical records were collected after participants were evaluated and enrolled. Of the 584 enrollees, 371 were selected for the present analyses, representing all subjects with complete data on the variables of interest, including demographic, cognitive, diagnostic, and primary care information. Subjects with motor or sensory impairment precluding administration of cognitive screens were excluded, as were individuals without a primary doctor or for whom no or only fragmentary outpatient records could be obtained. Primary care physicians were offered no incentive to provide records other than reimbursement for actual expenses.

Enrollees completed a clinical research assessment adapted from the CERAD protocols (Morris *et al.*, 1989). The CERAD protocol calls for a cognitive history obtained from an informant, including a checklist of symptoms, answered yes, no, and don't know, across seven domains (memory, language, personality and behavior, orientation to time and place, activities of daily living, social, community, intellectual activities and employment, judgment and problem solving). For subjects reported to be impaired, additional queries were made to estimate date and mode of onset and interval course. The examiner may make additional observations of the subject across the dimensions of impairment and enters an overall appraisal of whether the patient is likely to have dementia, defined (CERAD) as normal consciousness with memory and other cognitive deficits sufficient to impair function in everyday activities. Based on this structured history, subjects were initially classified as probably impaired or probably not impaired.

Cognitive assessments included the Mini-Cog and the Cognitive Abilities Screening Instrument (CASI, Teng *et al.*, 1994; McCurry 2001; Lin *et al.*, 2002), administered in the patient's primary spoken language. Because of its availability in multiple language versions, the CASI replaced the CERAD neuropsychological battery. At the outset, the CASI's performance in this heterogeneous sample was unknown, so subjects' scores were not used as primary data for cognitive classification. Post-hoc analysis of CASI scores against the clinical diagnosis of cognitive impairment (present/absent) was good to excellent with its standard cut point of $\geq$ 80/100 (higher scores better) for subjects with at least 8 years of education (sensitivity $>$ 90%, specificity $>$ 96%). Below that level, the optimal cut points varied (5–8 years, $\geq$ 75; $<$ 5 years, $\geq$ 60).

The Mini-Cog (Borson *et al.*, 2000) combines a three-item recall task with an elective clock drawing task and is scored by assigning 1 point to each correctly recalled item and 2 points for a correctly drawn clock or 0 points for an incorrect clock. This scoring system translates the original published algorithm (Borson *et al.* 2000; Scanlan and Borson, 2001) into a quantitative scale with possible scores of 0–5. Clock drawings are scored as normal if all numbers 1–12, each only once, are present in the correct order and direction (clockwise); two hands of any length are present, one pointing to 8 and one pointing to 4 (depicting the time 8.20). Clocks lacking any of these elements are assigned 0 points, and refusal or inability to draw a clock was scored as abnormal. Based on our prior validation studies, Mini-Cog scores of 0–2 are in the 'probably impaired' range and scores of 3–5 are in the 'probably not impaired' range; this cutting score was used in determining the accuracy of the Mini-Cog in classifying subjects.

In addition to cognitive assessment of subjects, a uniform semi-structured informant centered interview was conducted, including the Clinical Dementia Rating interview (Hughes *et al.*, 1982), the 16-item IQCODE (Jorm *et al.*, 1991), and the Lawton Brody basic and independent ADL scales (Lawton and Brody, 1969), as was a detailed medical history and examination. The IQCODE and functional scales were used qualitatively in the consensus process to assess gross inconsistency across informant-rated measures but not for assignment of overall cognitive class. Following these evaluations, participants were given a final classification as demented, very mildly impaired, and non-demented using a consensus

process and the CDR score to anchor cognitive stage (0 = no impairment; 0.5, mild cognitive impairment with minimal functional impact; 1–3 + = demented). The final classification agreed with the preliminary classification by informants' history in 98.5% of cases when subjects were judged non-demented or demented, and in 48% when the final classification was MCI, with the research assessment identifying more MCI subjects than family informants. The overall rate of cognitive impairment was 62% in the sample as a whole.

Finally, a presumptive etiological diagnosis was assigned to each demented subject following the completion of the research battery and review of all available medical records, using DMS-IV criteria for AD and vascular dementia (APA, 1994) and NINCDS-ADRDA criteria for probable AD (McKhann *et al.*, 1984), as well as research criteria for several other types of dementia (Roman *et al.*, 1993; The Lund and Manchester Groups, 1994; Del Ser *et al.*, 2000; Campbell *et al.*, 2001; Zekry *et al.*, 2002).

Primary care encounters and physicians' recognition of cognitive impairment

Medical records provided by primary physicians, with subject/proxy consent, were systematically examined for documentation of suspected or diagnosed cognitive impairment, depression, duration of care by the physician, number of primary care visits prior to the initial research evaluation (≥ 1 in the prior year), and time interval between the most recent primary care visit and the research evaluation. Recognition of cognitive impairment was judged present if any cognitive diagnosis or prescription of anti-dementia medication was recorded, or if the primary physician had administered a cognitive screening instrument and stated that the score was abnormal. We did not adjust such scores post-hoc for variations attributable to education or other factors, and we do not know whether physicians may have applied such adjustments themselves. Our interest was in clarifying whether physicians believed the patient to be impaired, based on his/her medical notes. Indications of cognitive screening by primary care physicians were present for 25% of the group judged cognitively impaired by research criteria (CDR = 0.5–3 +) and for 7.7% of those judged to be non-impaired. Physicians classified 3% of subjects as impaired who were later judged normal by research criteria; available data are not adequate to determine whether these cases represented a reversible cognitive syndrome or simply discrepant judgements by physicians and researchers.

One hundred and ninety-nine physicians were represented, of which 61% were general internists, 29% family practitioners, 5% geriatricians, and 5% other/unknown. Over 60% of physicians were white English-speakers, but all ethnolinguistic groups represented in the subject sample, and some others, were also found among the physicians. Concordance between the ethnolinguistic group of each patient and his/her physician was recorded.

Data Analysis

Recognition of cognitive impairment by the Mini-Cog and subjects' own physicians were compared using logistic regression analyses with cognitive diagnosis (normal, MCI, or demented, and, if demented, the etiology) as dependent outcomes. The impact of demographic, diagnostic, and health care variables on the accuracy of cognitive classification by the Mini-Cog and physicians' notes was examined in regressions using Mini-Cog and physicians classifications as dependent outcomes. To maximize statistical power and stability in analyzing demographic confounders, only ethnic groups representing $> 10\%$ of the sample (Asian-American, African-American, and Hispanic) were tested for effects of ethnicity on recognition of impairment. The McNemar statistic was used to examine differences between the Mini-Cog and physicians in correctly classifying cognitively impaired subjects over all subjects, across severity of impairment, and across clinical dementia types.

Variables that might affect the accuracy of classification included demographic and health care related factors. Demographic factors included age, gender, language, English *vs.* non-English; ethnicity: African-American, Asian-American, and Hispanic; education: high > 9 years, low < 8 years; literacy: literate, 76%, semi and illiterate, 24%). Factors related to health care included health insurance, income level, physician specialty, number of visits, time between last visit and research evaluation, and total duration of the current primary care relationship. All variables were tested as predictors in bivariate and regression analyses.

RESULTS

Overall recognition of impairment by Mini-Cog vs physicians

The Mini-Cog was more sensitive to the presence of cognitive impairment than were subjects' physicians in the entire group and at each level of impairment

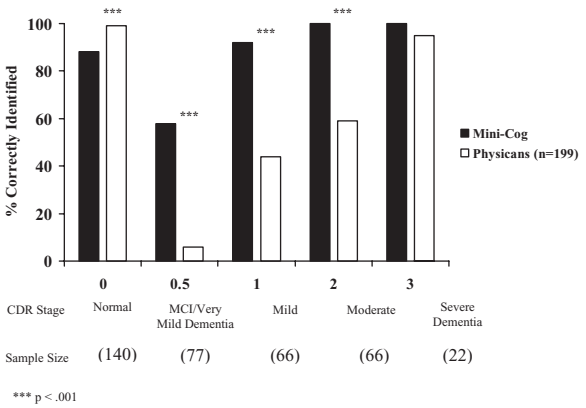

Figure 1. Classification of impairment by the Mini-Cog *vs* physicians (all subjects)

(McNemar, all $p < 0.001$, Figure 1) except severe dementia (CDR 3+). At CDR 1–3+ combined, the Mini-Cog correctly identified 97% of demented individuals, while physicians identified 58%. Detection rates were equivalent in severe dementia (CDR 3+, 22 subjects), so this group was excluded from further comparative analyses, leaving 209 subjects in stages 0.5, 1 and 2 combined. We then determined whether the Mini-Cog and physicians recognized impairment in the same or different individuals. Fifty percent were recognized by the Mini-Cog but not by physicians, 32% by both, and 15% by neither. Only 3% were recognized by physicians but not by the Mini-Cog. The overall accuracy of the Mini-Cog and physicians in classifying subjects as cognitively impaired or normal, represented by the formula (true positives + true negatives/true positives + true negatives + false positives + false negatives), was 83% and 59%, respectively.

Predictors of recognition

Severity of cognitive impairment (Figure 1). At CDR 0.5 ($n = 77$), the Mini-Cog was much more sensitive than subjects' own physicians, recognizing impairment in 58% *vs* 6% ($p < 0.001$). At CDR 1, the Mini-Cog was over twice as likely as physicians to detect impairment (92% *vs* 41%, $p < 0.001$), and remained significantly better at CDR 2 (100% *vs* 59%, $p < 0.001$). At CDR 3+, the Mini-Cog and physicians' judgments converged (100% *vs* 95%, $p =$ ns).

Dementia subtype (Table 1). Table 1 shows the relative performance of the Mini-Cog and physicians in detecting cognitive impairment in subjects whose impairments were of different etiologies. In subjects with probable AD, the Mini-Cog detected dementia more accurately (99%) than physicians (62%). Physicians' detection of dementia in subjects with non-AD etiologies was relatively poorer, ranging from 45 to 56%, while the Mini-Cog detected most cases (91 to 100%). Dementia subtype had an independent effect on physician recognition ($p < 0.005$ in stepwise logistic regressions including dementia severity and demographic variables).

Table 1. Recognition of specific cognitive disorders by Mini-Cog and primary care physicians

Diagnosis	Recognition of Impairment, N (%)[b]		
	Total N (%)[a]	By Mini-Cog	By Physicians
Dementias			
Probable AD	112 (47)	111 (99)	69 (62)**
AD + vascular dementia	22 (10)	20 (91)	15 (56)*
Vascular dementia	15 (6)	15 (100)	6 (40)**
Other dementias	11 (6)	9 (82)	5 (45)*
Mild Cognitive Impairment	71 (32)	39 (55)	4 (6)**
Total	231	194 (84%)	94 (41%)

Mini-Cog superior to physician detection of cognitive impairment in all diagnostic subgroups. *$p < 0.05$, **$p < 0.01$ (McNemar).
[a]%indicates percent of all cognitively impaired subjects.
[b]%indicates percent of recognized impaired subjects in each diagnostic group.

Demographic factors: ethnicity, language, education and literacy (Table 2). Results of bivariate analyses of the impact of demographic factors on recognition of cognitive impairment are shown in Table 2. In multivariate regressions, non-English speaking status of subjects was the only significant ($p < 0.05$) demographic confounder of physician recognition, as bivariate effects of education and literacy were eliminated by shared variance with language. More non-English than English speakers had low education (54% *vs* 32%, $p < 0.05$) and low literacy (33% *vs* 7%, $p < 0.05$). While not significant at the $p < 0.05$ level, there was some evidence suggesting possible interaction between diagnostic subtype and demographic factors; e.g. if subjects were illiterate non-English speakers with a dementia other than AD, none (0%) were detected as impaired by their physicians.

Health care, provider specialty, and encounter variables. Low income and lack of health insurance were associated with lower rates of physician recognition of cognitive impairment, but in multivariate

Table 2. Comparative Demographic Influences on Recognition of Cognitive Impairment (CDR = 0.5, 1, and 2 only; $n = 209$)

	By Mini-Cog[a] (%)	By Physician[b] (%)	OR[c]
Education			
≥ 9 years	77	38	2.03
< 9 years	89	32	2.78
Literacy			
Literate	78	38	2.05
Semi/illiterate	94	25	3.76
Language			
English speaking	83	45	1.84
Non-English speaking	82	30	2.73
Ethnicity			
African-American	82	47	1.74
Asian-American	81	38	2.13
Hispanic	77	24	3.21

[a]For all groups, recognition by Mini-Cog exceeded that of physicians (McNemar, $p < 0.01$).
[b]Pysician recognition lower for semi and nonliterate and non-English speaking subjects ($p < 0.05$). Race differences, significant in zero order analyses, were eliminated in regressions including dementia severity and language.
[c]Odds of recognition by Mini-Cog relative to physicians.

analyses were no longer significant, as they were strongly outweighed by dementia stage ($\chi^2 = 21.3$, $p < 0.0001$), dementia type (AD *vs* other, $\chi^2 = 7.7$, $p = 0.005$), and language (English/non-English, $\chi^2 = 5.96$, $p = 0.015$) [overall $\chi^2 = 52.9$, df = 3, $p < 0.0001$]. Ethnolinguistic concordance between patients and physicians was unrelated to recognition of cognitive impairment.

Because physician specialty and duration of the provider relationship might affect recognition of cognitive impairment, practice and encounter variables were also examined as possible modifying factors. Rates of recognition by geriatricians were better than by other primary care providers ($p = 0.015$). Rates for general internists and family practitioners did not differ from each other. In multivariate analyses, physician specialty had no significant effect, and statistical power was too low for sound analysis of interactions between specialty and dementia stage.

Across all physician types, the mean ± SD duration of the primary care relationship was 35 ± 38 months and the mean ± SD number of recorded physician visits available per subject was 13 ± 15. Ninety percent of subjects had seen their primary care physician within the past year, with a mean interval of 4 ± 8 months between the last primary care visit and the research assessment. Encounter variables were evaluated in stepwise logistic regressions predicting physician recognition in both the entire sample of impaired subjects (CDR 0.5–3) and the smaller subsample with CDR 0.5–2 (since nearly all of the severely demented subjects were recognized as such by their physicians). In none of these analyses did duration of relationship, number of visits, or delay between primary care and research visits contribute significantly.

In addition, we considered whether primary care physicians might diagnose depression or anxiety in MCI or demented patients whom they did not recognize as being cognitively impaired. For this analysis, subjects with dementia and MCI/very mild dementia were combined into a 'cognitively impaired' group for comparison with the non-impaired group. No differences were found in rates of documented depressive or anxiety symptoms or treatments between cognitively normal (21%) and cognitively impaired (19%) patients. Mood symptoms therefore did not appear to confound physician recognition of cognitive disorders in this sample.

DISCUSSION

Many generalist physicians presume that dementia is relatively easy to detect (Tangalos *et al.*, 1996). However, previous studies show that primary care physicians have difficulty recognizing milder dementia in their patients (Valcour *et al.*, 2000; Löppönen 2003; Boise *et al.*, 2004). The present findings are consistent with these observations and show that a very short screen, the Mini-Cog, can detect dementia much earlier and more efficiently than physicians in usual general practice settings.

Results of this study have particular implications for multicultural older populations, as sociodemographic factors had substantial effects on recognition of cognitive impairment by physicians and much less effect on the Mini-Cog. The Mini-Cog appears to be relatively free of bias by demographic variations and false-positive classification in the least-advantaged subjects (Borson *et al.*, 2005).

This study has a number of strengths: simultaneous comparison of primary care doctors' recognition of cognitive impairment with that of a standardized clinical dementia assessment and a simple cognitive screen; assessment of multiple sources of confounding; inclusion of common dementia subtypes as potential influences on detection of dementia, and inclusion of MCI subjects who are particularly difficult to detect by screening. Analysis by CDR stages demonstrates that the Mini-Cog would contribute the most to dementia detection by primary doctors early in its development (very mild and mild stages) and under other conditions that challenge effective

detection of cognitive impairment, including education and language differences.

Limitations of this study include non-random and non-representative sampling, lack of a mainstream comparison group, and reliance on medical records to infer physicians' knowledge about a subject's impairment. The Mini-Cog's performance in this sample will be better than expected in epidemiological surveys of representative samples owing to the much higher prevalence of dementia, and may not represent typical performance in unselected primary care populations, which has not yet been systematically evaluated. Similarly, rates of recognition by physicians could be unrepresentative because physicians were not directly asked whether they thought a patient was cognitively impaired. However, overall recognition rates were well within the range reported by others using very different screening and sampling approaches with very different (usually mainstream) populations.

This study demonstrates that use of a simple, brief cognitive screen in primary care could greatly improve detection of impairment among older patients. It does not address the question of whether earlier detection alters health outcomes (Boustani *et al.*, 2003), although identification of dementia by physicians is strongly encouraged as a matter of good clinical practice. Screening by itself cannot prevent under-diagnosis and under-treatment, since even when dementia is suspected physicians do not consistently adhere to recommended diagnostic or treatment practices (Glasser *et al.*, 1994; Boise *et al.*, 2004). Models for dementia evaluation and management in primary care are emerging (Reuben *et al.*, 2003; Cherry *et al.*, 2004); simple screens such as the Mini-Cog provide the first component of a practical model.

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