BRIEF METHODOLOGICAL REPORT

The GPCOG: A New Screening Test for Dementia Designed for General Practice

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OBJECTIVES: To design and test a brief, efficient dementia-screening instrument for use by general practitioners (GPs).

DESIGN: The General Practitioner Assessment of Cognition (GPCOG) consists of cognitive test items and historical questions asked of an informant. The validity of the measure was assessed by comparison with the criterion standard of diagnoses of dementia derived from the *Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition)*.

SETTING: Primary care doctors' offices.

PARTICIPANTS: Sixty-seven GPs administered the GPCOG to 283 community-dwelling patients aged 50 to 74 with memory complaints or aged 75 and older.

MEASUREMENTS: The Cambridge Mental Disorder of the Elderly Examination, the Abbreviated Mental Test (AMT), the Mini-Mental State Examination (MMSE), the 15-item Geriatric Depression Scale, and the 12-item Short-Form Health Survey.

RESULTS: The GPCOG was reliable and superior to the AMT (and possibly to the MMSE) in detecting dementia. The two-stage method of administering the GPCOG (cognitive testing followed by informant questions if necessary) had a sensitivity of 0.85, a specificity of 0.86, a misclassification rate of 14%, and positive predictive value of 71.4%. Patient interviews took less than 4 minutes to administer and informant interviews less than 2 minutes. The instrument was reported by GPs to be practical to administer and was acceptable to patients.

CONCLUSION: The GPCOG is a valid, efficient, well-accepted instrument for dementia screening in primary care. **J Am Geriatr Soc 50:530–534, 2002.**

Key words: dementia; primary care; general practice; screening; cognitive impairment; diagnosis; Alzheimer's disease

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Dementia is often underdiagnosed by primary care physicians or general practitioners (GPs).[1–3] One of the many reasons for this is the lack of a brief screening instrument designed specifically for primary care, because GPs find existing screening tests such as the Mini-Mental State Examination (MMSE) unsatisfactory and tend not to use them.[1,4–7]

In response to this expressed need, we tested a new instrument, the General Practitioner Assessment of Cognition (GPCOG), designed to assist GPs in detecting dementia. We aimed to demonstrate that this instrument was valid, reliable, quick to administer, easy to use, and acceptable to GPs and their patients and that it represented an advance over current screening tests.

METHOD

The Development of the GPCOG Instrument

This test was novel in that it included informant and cognitive testing items, the combination of which can increase predictive power.[8] Items were derived from three sources: the Cambridge Cognitive Examination (CAMCOG),[9,10] the Psychogeriatric Assessment Scale,[11] and the instrumental activities of daily living scale.[12] Selection of items was based on demonstrated sensitivity, nonredundancy, and likely patient and GP acceptability. The instrument that was field-tested comprised two sections: the GPCOG patient section, consisting of cognitive test items (maximum score = 15), and the GPCOG informant section, consisting of eight historical questions (maximum = 8). We subsequently developed a refined GPCOG consisting of nine cognitive and six informant items (see Results).

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Participants

Of 380 community-dwelling patients recruited by their GPs, 283 completed the study. Patients were included if they were aged 75 years or more regardless of cognitive status. To imitate usual practice, subjects aged 50 to 74 suspected of having a memory problem were also included. Patients were excluded if they resided in a nursing home; if they had a diagnosis of depression or delirium; or if poor English language abilities, sight, or hearing precluded testing. The study had institutional ethics committee approval and participants gave written informed consent.

General Practitioners

A convenience sample of 67 GPs was recruited through four regional Divisions of General Practice, reflecting a broad socioeconomic cross-section. Sixty-six percent of the 67 participating GPs were male, their average age was 52 (range 31–81), they had worked an average of 23 years in general practice, and most had received medical training in Australia (71%). They were similar to Australian GPs as regards gender and training but were older ($\chi^2 = 9.75$, $df = 4$, $P = .045$).

Instruments

The GP-administered 10-item Abbreviated Mental Test (AMT)[13] and psychologist-administered MMSE[4] were used as comparison tests. The 15-item Geriatric Depression Scale[14] and the 12-item Short-Form Health Survey[15] were used to investigate the influence of physical and mental health on GPCOG scores.

A slightly modified Cambridge Mental Disorder of the Elderly Examination (CAMDEX)[10] (excluding physical examination and laboratory investigations) allowed the derivation of criterion standard *Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition)* (DSM-IV)[16] diagnoses of dementia, CAMCOG and MMSE[4] scores, and classification of severity. The intraclass correlation of two research psychologists simultaneously administering the CAMDEX to 25 patients was 0.983 (95% confidence interval (CI) = 0.946–0.995).

Patient and GP satisfaction were evaluated using anonymous self-completed questionnaires developed by the research team. GPs were asked about their general satisfaction with the measure (on a five-point scale) and whether they considered the GPCOG schedule to be practical, acceptable to patients, and economically viable in the current healthcare system. They were also asked whether they would continue to use the GPCOG should it prove to be valid and reliable. Patients were asked to rate on five-point scales how they felt about the screening test (from "disliked it a lot" to "liked it a lot").

Procedure

GPs were asked to administer the GPCOG (before subsequent refinement) and AMT to consecutive eligible patients and to contact an informant (by telephone or in person) who had known the patient for at least 5 years. Approximately 5 weeks later, a research psychologist visited the patient at home, administered the various instruments, including the CAMDEX and the GPCOG again, and, where possible, interviewed an informant. Consensus diagnoses of dementia and delirium were established according to DSM-IV criteria on all 156 subjects suspected to be cognitively impaired (CAMCOG score ≤ 84) and a random sample of 20 cognitively intact individuals (CAMCOG score >84) (62.2% of all cases reviewed). No case was found to meet criteria for delirium.

Analyses

Receiver operator characteristic (ROC) analyses were used to assess the GPCOG patient section, informant section, total score, and two-stage test as screening tools for DSM-IV–defined dementia. The ROC curve is constructed by plotting the true-positive ratio against the false-positive ratio for each possible cutoff point of the test. The area under this curve (AUC) therefore represents the probability that demented and nondemented subjects are correctly ranked by the test according to their diagnostic status. Chi-square tests[17] were used to compare AUCs for the GPCOG patient and informant subscales, the GPCOG total score and two-stage test, and the AMT and the MMSE.

RESULTS

Of the 380 subjects recruited by GPs, 47 withdrew from the study, 24 did not meet the study's inclusion/exclusion criteria, and 26 were unable to receive a home visit for various reasons. The 73 subjects who did not participate did not significantly differ from the 283 participants (74.5% of the original sample) as regarded age ($t = -1.70$, $df = 322$, $P = .376$), gender ($\chi^2 = 1.11$, $df = 1$, $P = .292$), or AMT score (nonparticipants n = 55; $t = 0.89$, $df = 322$, $P = .376$).

A diagnosis of DSM-IV–defined dementia, made in 82 patients, was judged using CAMDEX criteria to be of minimal severity in 17.1%, mild in 51.2%, moderate in 26.9% and severe in 4.9%. A further 50 patients were considered clinically to have possible or probable dementia but failed to meet DSM criteria (usually because there was a lack of history to corroborate cognitive or functional decline). There were no differences between participants diagnosed with dementia and those without dementia as regards gender (40.6% of the sample were male), relationship with informant (40.6% were spouses), living arrangements (87.6% lived in a private home and the others in retirement villages or hostels), or education (mean ± standard deviation = 9.4 ± 3.0 years). Patients' overall mean age was 79.6 ± 6.1 (range = 56–94); 32 patients (11.3%) were aged 50 to 75. Those diagnosed with dementia were older (mean 80.7 ± 6.8) than those without dementia (79.1 ± 5.7; $P < .05$) and less likely to be living with an informant (71.1% and 82.9%, respectively, $P < .05$).

The GPCOG subscales were refined by eliminating items that were completed incorrectly by fewer than 5% of patients, affirmed by fewer than 10% of informants, or did not assist in the discrimination of dementia diagnostic prediction as determined by logistic regression analyses. The refined GPCOG, consisting of a cognitive testing (patient) section of four items and an historical (informant) section of six items (see Appendix 1), was used for subsequent analyses, unless otherwise specified. The GPCOG patient section score was the total number of correct responses, maximum score = 9; the informant section score was the total number of "no" responses, maximum score = 6. Higher scores indicated better function.

For the GPCOG patient section, reliability was high: GPs' interrater intraclass correlation coefficients (ICC) = 0.75 (n = 37, 95% CI = 0.56–0.86, $P < .001$), test-retest ICC = 0.87 (n = 71, 95% CI = 0.80–0.92, $P < .001$), and internal consistency (Cronbach's α) was 0.84 (n = 277). For the GPCOG informant section, reliability was satisfactory: GPs' interrater ICC = 0.56 (n = 20, 95% CI = 0.19–0.81, $P = .003$), test-retest ICC = 0.84 (n = 36, 95% CI = 0.70–0.91, $P = .001$), and internal consistency (Cronbach's α) was 0.80.

Sensitivities, specificities, positive and negative predictive values (PPVs and NPVs), and misclassification rates were examined for the two subscales separately, together, or sequentially (two-stage method). The two-stage sequential protocol was streamlined so that patients scoring greater than 8 or less than 5 on the GPCOG patient section were assumed to be cognitively intact or impaired, respectively, and informant questioning deemed unnecessary. For patients scoring 5, 6, 7, or 8 on cognitive testing, scores of 3 or less out of 6 on the informant section indicated cognitive impairment.

The patient and informant sections each had a high sensitivity and moderate specificity. The total and the two-stage methods each resulted in increased specificity without any appreciable change in sensitivity while reducing the misclassification rates (see Table 1). To perform ROC analyses, informant scores were imputed to be the maximum of 6 or the minimum of 0 for patients whose cognitive scores were greater than 8 or less than 5, respectively. For those who scored from 5 to 8, the informant score was the actual score obtained. ROC curves obtained are shown in Figure 1. ROC analysis showed that there was no significant difference between the AUCs of the total score method and the two-stage method ($\chi^2 = 1.48$, $df = 1$, $P = .250$). The two-stage method of combining the subscales was significantly superior to either of the subscales alone ($\chi^2 = 13.03$, $df = 2$, $P = .005$). The AUC of the two-stage GPCOG score was significantly superior to the AMT ($\chi^2 = 17.17$, $df = 1$, $P = .001$).

Post hoc, we compared the ability of the MMSE, using the recommended cutpoint of 23/24[4] and the two-stage refined GPCOG to detect cases of dementia. The sensitivity, specificity, misclassification rate, and AUC were similar to those for the GPCOG (see Table 1, AUC not significantly different from two-step method; $\chi^2 = 2.22$, $df = 1$, $P < .10$). The GPCOG patient section and MMSE were strongly correlated (Pearson's $r = 0.683$, $P = .001$).

The mean time for GPs to complete the unrefined patient section of the GPCOG was 9.5 minutes (range = 2–25 minutes, n = 260) and for the unrefined informant section 3.5 minutes (range = 1–15 minutes, n = 195). For the refined GPCOG measure, administered to 20 psychogeriatric outpatients, average times were 3.3 minutes for the patient section (± 1.08, range 2–5.8 minutes) and 1.2 minutes for the informant section (± 0.64, range 0.5–2.5 minutes).

Ratings from 49 of 67 GPs (73%) who anonymously completed a satisfaction survey indicated that the measure was practical (87.8%), economically viable (87.8%), and acceptable to patients (98%). Also, 83.7% of GPs were either satisfied or very satisfied with the GPCOG measure, and 89.8% said they would continue using it. Of the 333 subjects who anonymously completed the satisfaction survey, 76.3% either liked the examination a bit or a lot, 18.3% neither liked nor disliked it, 2.1% disliked it, and 2.4% felt unsure.

DISCUSSION

The advantages of the GPCOG over current brief screening instruments are that it combines patient and informant data, is quick to administer, has been validated in a primary care setting, and has sound psychometric properties. Psychometrically, it performed better as a screening instrument than the AMT and slightly (although nonsignificantly) better than the MMSE but was quicker and likely to be more acceptable to GPs and patients. This at-least-equal performance occurred despite the post hoc analysis overestimating the ability of the MMSE because of rater bias (adminis-

Table 1. Sensitivity, Specificity, and Area under the Curve (AUC) for General Practitioner Assessment of Cognition (GPCOG) Patient and Informant Sections, GPCOG Total Score, GPCOG "Two-Stage" Method, Mini-Mental State Examination (MMSE), and Abbreviated Mental Test (AMT)

Variable	GPCOG Patient Section	GPCOG Informant Section	GPCOG Total Score	Two-Stage Method†	MMSE	AMT
Cutpoint	7/8	4/5	10/11		24/25	7/8
Maximum score	9	6	15		30	10
N*	282	202	202	246	283	269
Sensitivity	0.82	0.89	0.82	0.85	0.81	0.42
Specificity	0.70	0.66	0.83	0.86	0.76	0.93
Positive predictive value†	0.53	0.52	0.67	0.71	0.57	0.71
Negative predictive value†	0.90	0.94	0.92	0.93	0.90	0.80
Misclassification rate†	26.5%	27.2%	17.3%	14.2%	23.0%	21.8%
AUC	0.86	0.84	0.91	0.89	0.85	0.78
AUC 95% confidence interval	0.81–0.91	0.79–0.90	0.86–0.95	0.85–0.94	0.80–0.90	0.71–0.84
Standard error of AUCs	0.035	0.030	0.023	0.025	0.024	0.032

*N varies because of missing data. For "two-stage" method, GP-derived informant data were only required when the GPCOG patient section was 5 to 8 out of a possible 9.
†Based on a standard 29% prevalence of dementia as found in the full sample (n = 283).

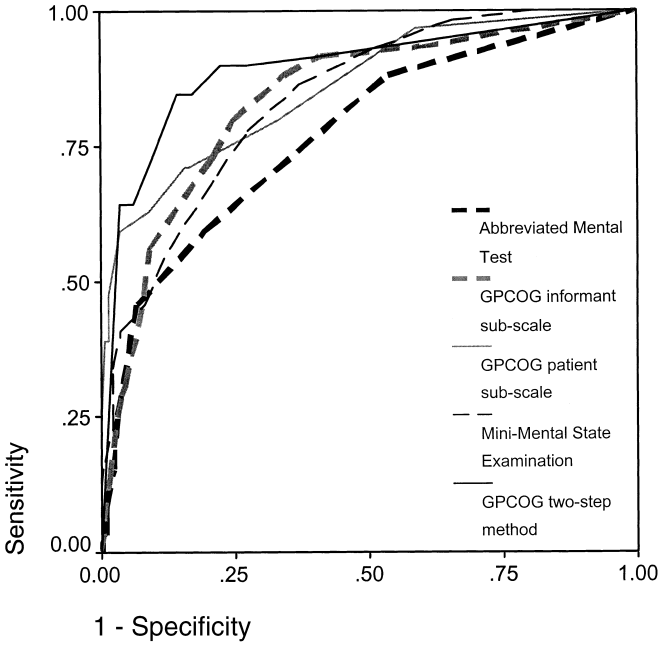

Figure 1. The receiver operating characteristic (ROC) curves for each test as a screen for dementia. GPCOG = General Practitioner Assessment of Cognition.

tered by research psychologists not GPs) and circularity of process (data from the MMSE were used to derive DSM diagnoses).

The two-stage procedure is time efficient (only 47.7% of cases required the informant to be contacted) without sacrificing classificatory power and has high sensitivity, specificity, PPV and NPV. Only 7% of patients who were identified as nondemented by the GPCOG had dementia (NPV = 0.933), and, of the false positives (abnormal GPCOG but no DSM-defined dementia), 38% had definite cognitive impairment but did not meet diagnostic criteria for dementia. In addition, the vast majority of GPs rated the GPCOG as being practical, economically feasible, and acceptable to patients. Using the refined version of the GPCOG, we performed cognitive testing in less than 4 minutes and administered the informant section in less than 2 minutes; this is now being reevaluated in a primary care setting.

Further advantages of the GPCOG are that performance appeared to be independent of the patient's Geriatric Depression Scale score, age, gender, years of education, and physical and mental health (data not presented here). Limitations include the use of a volunteer convenience sample of GPs, the need to test the instrument in other populations, the likelihood (given the high prevalence of dementia in this sample) that GPs did not always follow instructions and select consecutive patients to whom to administer the GPCOG, and availability of an informant in only 75% of cases.

One of the strengths of the GPCOG lies in its inclusion of informant data. Clinicians specializing in the diagnosis of dementia rely heavily on family members' reports about the performance of patients, but this has not been a feature of primary care practice. The development of a systematic way of including informant data into general practice assessment represents an advance. Although the need to obtain an informant report may raise logistical difficulties for primary care providers, in countries such as the United Kingdom and Australia, government health systems are beginning to fund GPs for comprehensive assessment of patients and encourage caregiver involvement in care planning and case conferencing. As the general trend toward caregiver involvement increases, it is the ideal time to start educating GPs about a new approach to cognitive impairment screening.

We conclude that the GPCOG is a suitable instrument for use to screen for dementia in primary care. It is simple, brief, efficient, reliable, and valid and can meet the needs of GPs. We caution that screening is only the first step in the process of detecting dementia. Supplementary education for GPs is recommended. This should include information about how to administer the GPCOG, about the differential diagnosis of cognitive impairment, and about dementia management principles.

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Appendix

GPCOG Patient Examination

Unless specified, each question should only be asked once.

Name and address for subsequent recall test

1. *"I am going to give you a name and address. After I have said it, I want you to repeat it. Remember this name and address because I am going to ask you to tell it to me again in a few minutes: John Brown, 42 West Street, Kensington."* (Allow a maximum of 4 attempts but do not score yet)

	Correct	Incorrect
Time Orientation		
2. *What is the date?* (exact only)	☐	☐
Clock Drawing (visuospatial functioning) - use page with printed circle		
3. *Please mark in all the numbers to indicate the hours of a clock* (correct spacing required)	☐	☐
4. *Please mark in hands to show 10 minutes past eleven o'clock* (11:10)	☐	☐
Information		
5. *Can you tell me something that happened in the news recently? (*recently = in the last week)	☐	☐
Recall		
6. *What was the name and address I asked you to remember?*		
John	☐	☐
Brown	☐	☐
42	☐	☐
West (St)	☐	☐
Kensington	☐	☐

Scoring guidelines

Clock drawing: For a correct response to question 3, the numbers 12, 3, 6, and 9 should be in the correct quadrants of the circle and the other numbers should be approximately correctly placed. For a correct response to question 4, the hands should be pointing to the 11 and the 2, but do not penalize if the respondent fails to distinguish the long and short hands.

Information: Respondents are not required to provide extensive details, as long as they demonstrate awareness of a recent news story. If a general answer is given, such as "war," "a lot of rain," ask for details—if unable to give details, the answer should be scored as incorrect.

GPCOG Informant Interview

Ask the informant: *"Compared to a few years ago,*

		Yes	No	Don't Know	N/A
I.	*Does the patient have more trouble remembering things that have happened recently?*	☐	☐	☐	
II.	*Does he or she have more trouble recalling conversations a few days later?*	☐	☐	☐	
III.	*When speaking, does the patient have more difficulty in finding the right word or tend to use the wrong words more often?*	☐	☐	☐	
IV.	*Is the patient less able to manage money and financial affairs (e.g., paying bills, budgeting)?*	☐	☐	☐	☐
V.	*Is the patient less able to manage his or her medication independently?*	☐	☐	☐	☐
VI.	*Does the patient need more assistance with transport (either private or public)?*	☐	☐	☐	☐