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Characteristics of the GPCOG, a screening tool for cognitive impairment

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SUMMARY

Background Early dementia diagnosis is aided by the use of brief screening tests; scores can be biased by patient and informant characteristics such as age, gender and education.
Objective To assess whether the General Practitioner's Assessment of Cognition (GPCOG), a brief screening tool for detecting cognitive impairment comprising a patient cognitive test and questions to an informant, is biased by patient and informant characteristics.
Design Sixty-seven general practitioners recruited consecutive patients (with informants). Patients were subsequently assessed by a research psychologist, and DSM-IV diagnoses assigned following a case-conference.
Setting Primary Care.
Subjects Two hundred and eighty three home-dwelling individuals, 11.3% of whom were aged 50–74 years with suspected memory problems and the rest aged 75 or more.
Methods The GPCOG, Cambridge Mental Disorder of the Elderly Examination cognitive scale (CAMCOG), Geriatric Depression Scale (GDS), and the SF-12 Health Survey (SF-12) were administered and demographic data were collected and consensus DSM-IV diagnoses of dementia made. Relationships between patient and informant characteristics and the GPCOG measure were examined using Pearson correlations and linear regression analyses.
Results There were correlations in GPCOG-patient scores with age, education and depression scores but on regression analysis only age was associated with the GPCOG-patient section. The GPCOG-informant section was free of bias.
Conclusions The GPCOG has advantages for use in primary care and is free of many biases common in other scales.

KEY WORDS — dementia diagnosis; primary health care; bias; geriatric assessment

INTRODUCTION

In primary practice early detection of dementia is important, both for the wellbeing of patients, and because medications for the treatment of dementia are now available (Brodaty *et al*., 2001). Brief screening tests for cognitive impairment are a valuable tool that can be used by general practitioners in diagnostic investigations.

However, other factors such as age and education, which influence screening test scores, can compromise accuracy. For example, the Mini-Mental State Examination (MMSE; Folstein *et al.*, 1975) has been shown to be influenced by premorbid intelligence, social class, physical disability, age, gender and education (Jagger *et al.*, 1992; MacKenzie *et al*., 1996; Tangalos *et al.*, 1996; Wind *et al*., 1997). In addition, other brief screening tools such as the clock drawing test, the Cognitive Abilities Screening Instrument and the Abbreviated Mental Test have been shown to be affected by age, gender and education (Bonaiuto *et al*., 1992; Ainslie and Murden, 1993; MacKenzie *et al*.,

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1996; McCurry *et al*., 1999). Informant based screening tests such as the IQCODE (Jorm and Jacomb, 1989) may also be influenced by the age and gender of the patient (Khachaturian *et al*., 2000).

We designed a brief screening test of cognitive impairment, the General Practitioner Assessment of Cognition (GPCOG), for use by general practitioners (Brodaty *et al*., 2002). It has been shown to be a valid instrument for detecting dementia with sensitivity and specificity of 0.85 and 0.86 respectively in a representative general practice population. This paper aims to examine the potential bias of possibly confounding factors such as age, gender, education and depression on the GPCOG.

METHODS

Participants

A convenience sample of 67 GPs were enlisted through four regional Divisions of General Practice in Sydney and Wollongong, Australia. They recruited 380 community dwelling participants of whom 283 completed the study. Subjects were included if they were 50–74 years old and suspected of having a memory problem, or aged 75 years or more regardless of cognitive status. Patients were excluded from the study if they resided in a nursing home, were diagnosed as being depressed or delirious, or if poor English language abilities, sight or hearing precluded testing. All participants gave written informed consent, as approved by the Committee on Experimental Procedures Involving Human Subjects. (Further details on recruitment and GP characteristics, in Brodaty *et al.*, 2002.)

Instruments

Demographic data comprised the patient's age in years, gender, number of years of formal education, the informant's age (by 10 year age group), and frequency of informant contact with patient (cohabiting, 4–7 times per week, 1–3 times per week, every 2–4 weeks).

The General Practitioner Assessment of Cognition (GPCOG) (Brodaty *et al*., 2002) is intended for use in primary practice as a brief screening test for cognitive impairment. It has two sections—a patient examination (GPCOG-patient) with a maximum score of nine, and an informant interview with a maximum score of 6. The patient examination contains the following cognitive test items: time orientation, clock drawing, reporting a recent event and a word recall task. In the informant interview (GPCOG-informant), the informant is asked about the patient's memory of recent conversations, misplacing objects, word finding difficulties, ability to manage money, ability to manage medication, and need for travel assistance. A GPCOG-patient score of 9 indicates no cognitive impairment. If the GPCOG-patient score lies between 5 and 8 the GPCOG-informant should be administered. A GPCOG-patient score of 4 or lower or a GPCOG-informant section score of 3 or lower suggests cognitive impairment.

The 15-item Geriatric Depression Scale (GDS; Yesavage, 1988), a 15-item screening instrument for depression, was administered by research psychologists. Total score ≥ 6 indicates possible depression.

The SF-12 Health Survey (SF-12; Ware *et al*., 1995) measures individuals' self-ratings of physical and mental health and yields two sub-test scores—a physical component score (PCS) and a mental component score (MCS).

The Cambridge Mental Disorder of the Elderly Examination (CAMDEX; Roth *et al*., 1988) is a semi-structured diagnostic schedule which consists of a structured psychiatric interview with the patient, a test of cognitive abilities (called the CAMCOG) and a structured interview with a relative or informant. It is able to generate diagnoses of dementia with 97% sensitivity and 91% specificity against a gold standard of AGECAT organic syndrome (Blessed *et al.*, 1991).

Procedure

General practitioners recruited consecutive attendee patients who met the study's inclusion criteria. Informed consent was obtained by the GP, who also sought permission to contact an informant who had known the patient for at least 5 years. Informants were interviewed by telephone or in person.

An average of five weeks after the consultation, patients were visited at home by a research psychologist. The researcher, blind to the GP-administered GPCOG, collected demographics and administered the GPCOG, CAMCOG, GDS and SF-12. Where possible, the researcher also contacted the subject's informant for an interview face to face, or by telephone. Finally, all 156 subjects suspected to be cognitively impaired (CAMCOG score of 84 or less) and a random sample of 20 cognitively intact individuals (CAMCOG score greater than 84) were discussed in a case conference with an experienced clinician. In total, 176 of the 283 patients (62.2%) were

discussed. Consensus diagnoses of dementia were established using all available information except for GPCOG scores, according to DSM-IV criteria for dementia (American Psychiatric Association, 1994).

Analyses

GPCOG-total was calculated in two ways, according to the clinical diagnostic algorithm and the raw total. According to the algorithm if GPCOG-patient = 9, then GPCOG-total = 15; if GPCOG-patient score is between 5 and 8 inclusive, then GPCOG-total = GPCOG-patient + GPCOG-informant score; if GPCOG-patient < 5 then GPCOG-total = GPCOG-patient.

Pearson correlation coefficients with two-tailed tests of significance were used to evaluate the relationships between patient and informant characteristics and the GPCOG patient, GPCOG-informant and GPCOG-total sections in the total sample and in subjects without a diagnosis of dementia. In order to investigate the influence of patient or informant characteristics taking into account diagnosis, variables that correlated significantly with GPCOG-patient and GPCOG-total scores were entered stepwise into a linear regression. The influence of significantly correlated variables on correct response on individual GPCOG items was also examined using *t*-tests, only significant differences are reported. The critical value for significance after Bonferroni correction for multiple *t*-tests for each set of item groups was 0.017.

RESULTS

Demographics

The 283 participants were aged between 56 and 94 years (mean = 79.6; SD = 6.05) and had attended formal education for an average of 9.4 years (SD = 2.95); 168 (59.4%) were female, and eighty-two (29%) were impaired on the CAMCOG and received a diagnosis of dementia based on DSM-IV criteria at case conference. Thirty-two (11.7%) were under 75 years of age and selected by their GPs because of suspected memory problems. Seventy-four patients who screened positive on the CAMCOG were not given a diagnosis of dementia. The mean Geriatric Depression Scale score was 2.6 (SD = 2.39, range 0 to 12), with 37 participants (13.1%) reaching the cut-off for depression. The SF-12 PCS and MCS means for participants were 40.91 (SD = 8.68) and 56.06 (SD = 9.48) respectively. There was no significant correlation between patient age and education ($r = -0.090$, $p = 0.144$).

Of the participants, 248 had suitable informants who were interviewed by the research psychologists. Of these informants, 187 (75.4%) were female, the majority were spouses (40.7%) or children (33.5%) of the participants, and most were in their 70s (30.4%) or 50s (22.1%).

Compared to those without dementia, patients who were diagnosed with dementia had significantly lower GPCOG-patient scores (mean = 7.84, SD = 1.45; mean = 4.22, SD = 2.89 respectively, $t = 10.72$, df = 280, $p = 0.00$), lower GPCOG-informant scores (mean = 4.73, SD = 1.43; mean = 2.51, SD = 1.63 respectively, $t = 10.04$, df = 209, $p = 0.000$) and higher GDS scores (mean = 2.35, SD = 2.17 and mean = 3.28, SD = 2.77 respectively; $t = -2.728$, df = 281, $p = 0.007$).

Effect of patient and informant characteristics on GPCOG-patient score

The GPCOG-patient score was significantly correlated with patient age, years of education and GDS score (Table 1). There was no significant difference between males and females on GPCOG-patient score ($t = 0.797$, df = 281, $p = 0.328$). In non-demented subjects, GPCOG-patient score was significantly correlated with patient age and education ($n = 201$, $r = -0.206$, $p = 0.003$; $n = 189$, $r = 0.150$, $p = 0.039$, respectively) but not GDS score ($n = 137$, $r = -0.135$, $p = 0.117$).

DSM-IV dementia diagnosis, patient age and patient education were entered stepwise into a linear regression with GPCOG-patient score as the dependent variable. Dementia diagnosis ($\beta = -0.605$, $p = 0.000$) and age ($\beta = -0.122$, $p = 0.012$) were significant predictors of GPCOG patient score.

Effect of patient and informant characteristics on GPCOG-informant score

There were no significant correlations between GPCOG-informant score and patient or informant demographics (Table 1). There was also no significant association between frequency of contact between patient and informant and GPCOG informant score (Spearman $R = 0.102$, $p = 0.156$) and no significant difference between males and females on GPCOG-informant score ($t = 0.719$, df = 209, $p = 0.477$).

Effect of patient and informant characteristics on GPCOG-total score

GPCOG-total (clinical algorithm) was significantly correlated with patient age, education and GDS scores

Table 1. Correlation matrix for variables entered in analyses

		GPCOG total score	GPCOG Patient Cognitive Score	GPCOG Informant Score	Patient age	Patient's education	Informant age	GDS	SF-12 physical health
GPCOG Informant	Corr		0.559**						
Score	*n*		202						
Patient age	Corr	−0.204**	−0.187**	−0.070					
	n	252	282	202					
Patient's education	Corr	0.147*	0.148*	0.011	−0.090				
	n	238	266	191	267				
Informant age	Corr	0.082	0.075	0.042	−0.017	−0.004			
	n	226	247	192	248	234			
GDS	Corr	−0.161*	−0.128*	−0.120	−0.038	0.021	0.092		
	n	252	282	202	283	267	248		
SF-12 physical health	Corr	−0.082	−0.071	−0.008	−0.022	0.046	−0.020	−0.214**	
	n	240	267	193	268	252	235	268	
SF-12 mental health	Corr	0.011	0.038	0.082	0.035	−0.017	0.034	−0.508**	−0.136*
	n	240	267	193	268	252	235	268	268

*significant at 0.05; **significant at 0.01.

(Table 1). DSM-IV dementia diagnosis, patient age and patient education were entered stepwise into a linear regression with GPCOG-total (clinical algorithm) score as the dependent variable. Dementia diagnosis ($\beta = -0.544$, $p = 0.000$) and age ($\beta = -0.153$, $p = 0.005$) were significant predictors of GPCOG-total score. Patient education was the only variable correlated to raw total GPCOG score (Pearson's $R = 0.149$, $p = 0.035$). When entered into a linear regression with DSM-IV dementia diagnosis, education was not a significant predictor of raw total GPCOG ($\beta = 0.110$, $p = 0.107$; $\beta = -0.308$, $p = 0.000$ respectively).

Patient and informant characteristics and individual GPCOG items

Subjects who performed incorrectly on clock drawing (both numbers and hands), remembering a recent news story, remembering the number from the address and rated by informants needing assistance with transport were significantly older than those who performed correctly on those items and did not need help with transport ($t = 3.71$, $p = 0.000$; $t = 1.06$, $p = 0.000$, $t = 2.41$, $p = 0.017$; $t = 2.40$, $p = 0.017$; $t = 3.26$, $p = 0.001$). Subjects who were unable to set the hands of the clock correctly were also more depressed ($t = 2.69$, $p = 0.008$). There were no significant differences in education between subjects performing correctly or incorrectly on GPCOG items.

Diagnostic ability of GPCOG in different age and education groups

The diagnostic ability of the GPCOG (including both patient and informants sections as appropriate) in different groups by age, education and depression scores on the GDS is presented in Table 2. The GPCOG (using the algorithm) performed less well in subjects who were above 80 years of age, had less than 8 years education or were depressed on the GDS.

Table 2. Variation in diagnostic ability of GPCOG with age, education, depression

Sample (*n*)	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Misclassification
Aged < 75 (32)	0.82	0.94	0.90	0.88	11.1%
Aged 75 ≤ 80 (128)	0.81	0.95	0.77	0.96	7.9%
Aged > 80 (123)	0.88	0.72	0.67	0.90	21.9%
Edu ≤ 8 yrs (118)	0.82	0.89	0.78	0.91	13.5%
Edu > 8 yrs (149)	0.86	0.85	0.68	0.94	14.8%
Negative on GDS (246)	0.83	0.88	0.73	0.93	13.4%
Positive on GDS (37)	0.92	0.71	0.71	0.92	20.0%
Total sample (283)	0.85	0.86	0.72	0.93	14.2%

DISCUSSION

The aim of this paper was to determine what factors apart from cognitive impairment influence performance on the GPCOG. Age was associated with cognitive score, as would be expected given that age is a risk factor for cognitive impairment in general and dementia in particular (Huppert *et al*., 1994; Jorm and Jolley,1998). This relationship between age and poor cognitive performance remained significant even when subjects with dementia were excluded. Education and depression did not appear to alter the ability of the GPCOG-cognition section to detect dementia. The informant section of the GPCOG appeared to be unaffected by age, education or depression. Both sections were independent of SF-12 scores.

Limitations of this study include the possibility that the convenience sample of patients recruited by GPs may not be representative of the larger population. The relatively high rate of dementia indicates that GPs over-sampled people with cognitive decline. The sample was limited to home-dwelling individuals with adequate English proficiency, and it is not clear how factors such as age and education may impact on the result of individuals from other groups. We did not measure race or culture and so cannot determine whether the GPCOG is culture-fair. Finally, other informant characteristics that were not measured such as level of education and level of depression may have an influence on their ratings.

How does this influence use of the instrument? It performs at least as well as other extant instruments for screening for dementia and has the advantage of brevity and high acceptability by patients and doctors (Brodaty *et al*., 2002). Cognitive impairment has many causes other than dementia and caution is required in interpreting poor performance on cognitive testing alone in those over 80 years and to some extent in those who are depressed.

These data indicate that the GPCOG has advantages for use in primary care and is free of many biases common in other scales such as gender, education, physical and mental health. Future research should examine the performance of the GPCOG in other samples.

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