Screening for cognitive impairment in the elderly using the mini-mental state examination

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SUMMARY. The use by non-medical staff of a brief screening instrument (the mini-mental state examination) to detect cognitive impairment among the elderly in primary care is described. Patients aged 75 years and over registered with nine general practices in north and north west London were invited by their general practitioners to take part in the study and 1170 patients participated, a response rate of 90%. The prevalance of possible or probable cognitive impairment (score below 25 on the mini-mental state examination) was 12.8%. Six per cent of patients scored below 19, at which score a high probability of dementia exists, although less than a third of this group had a diagnosis of dementia in their medical records. There was no significant difference between men and women or by social class in the proportion of patients with low scores, but the proportion with dementia rose from 2.5% in those aged 75–79 years to 29.0% among those aged 90 years and over.

Under the new general practitioner contract there is a requirement to provide annual services to the elderly, including a 'mental assessment'. In a practice with a list size of 2000 around 130 patients are likely to be aged 75 years and over. Of these around 17 would require further assessment for possible dementia on the basis of results obtained using the mini-mental state examination.

Introduction

PREVIOUS studies have suggested that general practitioners underdiagnose dementia,[1] although recent findings show that the extent of underdiagnosing may not be as great as was originally thought.[2] Dementia comprises a constellation of cognitive, emotional and functional impairment,[3] and its social consequences are so significant that its early detection is thought to be important,[4] although no randomized trials of screening for cognitive impairment alone appear to have been undertaken. Under the new contract general practitioners are required to provide a range of services annually to patients aged 75 years and over, including a 'mental assessment'.[5]

O'Connor and colleagues have described the use of the mini-mental state examination as an instrument for the identification of potentially demented individuals in community surveys and have proposed the use of brief tests as an aid to early identification of demented patients in general practice.[2]

This report compares the diagnosis of dementia by general practitioners with the prevalence of cognitive impairment as measured by the mini-mental state examination and discusses the implications of using the mini-mental state examination as a case finding instrument in general practice.

Method

General practitioners in nine practices in the London boroughs of Brent and Islington agreed to allow access to their age–sex registers, from which the names and addresses of all registered patients over the age of 75 years were extracted. These patients were asked by their general practitioner to take part in a study of the mental and physical health and use of medical and social services among the elderly. All of those who agreed to participate were interviewed by trained non-medical field workers using a standard schedule. The general practice medical records of all participants were scrutinized by one research worker with a nursing background and all major diagnoses were recorded.

All participants had a brief interview which included the mini-mental state examination and collection of demographic data. The mini-mental state examination has been extensively validated, is acceptable to patients, and is judged to be an effective screening instrument for cognitive impairment.[6] In the question to test attention and calculation the option of serial subtraction of seven from 100 (93, 86, 79 etc) or spelling WORLD backwards is given. In this study respondents were asked to spell WORLD backwards and only asked serial sevens if their literacy was in doubt.

Results were coded and entered on an SAS database. Statistical analysis was carried out using Minitab.

Results

Of the population of 1497 individuals over 75 years old identified, 132 were not at the address given on the general practitioner's age–sex register and 60 had died, leaving 1305 individuals who could be approached. Of these 113 refused to participate, and 22 others could not be contacted although there was no definite evidence that their addresses were wrong. A total of 1170 individuals agreed to take part in the study, a response rate of 90%. However, three participants were too ill to interview, three refused to continue the interview before reaching the mini-mental state examination, one carer intervened to stop the interview, two participants were so deaf that their answers were highly suspect, and one participant had too poor an understanding of English to answer reliably; all of these subjects were excluded from the analyses. Data was analysed from a total of 1160 participants.

This sample was overwhelmingly Europid (96.0%) and of UK origin (83.5%). There were 404 men (34.8%) and 756 women (65.2%). Marital status showed 13.6% were single, 33.1% married, 49.7% widowed, and 3.6% divorced or separated. General practices in Brent provided 44.6% of the sample while Islington practices provided 56.3%, and there was no statistically significant difference in the age distribution of the two borough populations. There was good consistency between interviewers;

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there were no significant differences in the mini-mental state examination scores of patients interviewed by the three fieldworkers who undertook the majority of the assessments.

Scores on the mini-mental state examination were grouped into three bands: 0–18, cognitive impairment; 19–24, possible cognitive impairment; and 25–30, no cognitive impairment. Seven subjects were too demented to answer any of the basic demographic questions in the brief interview, and so were allocated mini-mental state examination scores of zero. One hundred and forty nine participants (12.8%, 95% confidence interval 10.9%–14.8%) scored below 25 on the mini-mental state examination, suggesting possible or probable cognitive impairment. Of these 70 (6.0%, 95% confidence interval 4.7%–7.4%) scored below 19 at which score a high probability of dementia exists.

Cognitive impairment measured by the mini-mental state examination was significantly more common with increasing age (Table 1). The proportion of patients showing scores for cognitive impairment rose from 2.5% (95% confidence interval 1.2%–3.6%) in those aged 75–79 years to 29.0% (95% confidence interval 17.7%–40.3%) among those aged 90 plus years — a more than 10-fold increase. In contrast, there was only a two fold increase in scores for possible cognitive impairment across the same age range. There was no statistically significant difference in mini-mental state examination scores between sexes at either level of severity. Cognitive impairment occurred in 24 of the men (5.9%) and 46 of the women (6.1%), and possible cognitive impairment was found in 22 of the men (5.5%) and 57 of the women (7.5%). Cognitive impairment did not vary significantly with marital status nor with social class, although the proportion with mini-mental state examination scores of 25 and above was slightly lower among social classes 4 and 5.

Medical records were available for 1133 patients. Dementia was recorded in the medical records of 29.2% of those with mini-mental state examination scores of less than 19 and in 9.0% of those scoring between 19 and 24 (Table 2). Thus, overall, 18% of those with possible and probable dementia were already known to be demented. For seven patients (0.7%) who showed no cognitive impairment on the mini-mental state examination a diagnosis of dementia was recorded in the general practitioner's notes.

Table 2. Mini-mental state examination scores by recorded diagnosis of dementia.

Mini-mental state examination score	Number (%) of patients: 'Dementia' not recorded in notes	'Dementia' recorded in notes
Cognitive impairment 0–18 ($n=65$)	46 *(70.8)*	19 *(29.2)*
Possible cognitive impairment 19–24 ($n=78$)	71 *(91.0)*	7 *(9.0)*
No cognitive impairment 25–30 ($n=990$)	983 *(99.3)*	7 *(0.7)*
Total ($n=1133$)	1100 *(97.1)*	33 *(2.9)*

n = total number of patients whose records were examined; records not available for 27 cases.

Discussion

These results show a marked increase in cognitive impairment with age, confirming the rising prevalence of dementia with age found in other epidemiological surveys.[7] Thus much of the morbidity from dementia is concentrated in those aged over 80 years, with 50% of dementia cases being aged 85 years or more.

Our experience of using the mini-mental state examination confirms its value as a research instrument suitable for use in community surveys. Its acceptability to patients and consistency between interviewers suggest that it could also be used as a case-finding and screening instrument in clinical general practice. Further general practice based studies comparing the instrument with other brief instruments for detection of cognitive impairment would be helpful.

The mini-mental state examination has been well valididated and a US hospital based study showed a sensitivity of 87% and a specificity of 82% at an arbitrary cut-off score of 23/24.[8] O'Connor and colleagues found a sensitivity of 73% at a cut-off point of 23/24, equivalent to our cut-off of 24/25 because the use of the 'WORLD backwards' question results in slightly higher scoring. Using the Cambridge mental disorders of elderly examination interview (CAMDEX) as the 'gold standard' they found that 100% of patients were demented below a mini-mental state examination score cut-off of 15/16, that 73% were demented below a cut-off of 18/19 and that only 1% of those scoring 25 and above were suffering from dementia (personal communication).

Patients who have low scores on the mini-mental state examination need further assessment, which would have to be undertaken by the general practitioner or by a specialist. In our study population a maximum of 12.8% of the population would need further assessment. If our findings could be generalized, in an 'average' practice population of 2000 with 130 people aged 75 plus years, 17 individuals might need further assessment, of whom two would already be known to be demented. Interviewing relatives or other informants about changes in memory, judgement, personality, drive and self-care would be a simple, cost-effective way of ascertaining the presence of dementia in the majority of those with low mini-mental state examination scores, but specialist referral may be necessary where the diagnosis is uncertain. Other causes of a low mini-mental state examination score include delirium, depression, psychosis and educational disadvantage. Delirium is more likely to be found in acutely ill hospital inpatients rather than among patients in general practice, but questioning informants about the duration of confusion, together with evidence of clouding of consciousness, evidence from physical examination and knowledge

Table 1. Mini-mental state examination scores by age.

Mini-mental state examination score	Number (%) of patients: 75–79 years ($n=611$)	80–84 years ($n=333$)	85–89 years ($n=152$)	90+ years ($n=62$)	Total ($n=1160$)
Cognitive impairment 0–18	15 *(2.5)*	17 *(5.1)*	19 *(12.5)*	18 *(29.0)*	70 *(6.0)*
Possible cognitive impairment 19–24	25 *(4.1)*	27 *(8.1)*	20 *(13.2)*	7 *(11.3)*	79 *(6.8)*
No cognitive impairment 25–30	571 *(93.5)*	289 *(86.8)*	113 *(74.3)*	37 *(59.7)*	1011 *(87.2)*

χ^2 = 108.561, degrees of freedom = 6, $P<0.001$. *n* = total number of patients; age of two subjects was not recorded.

of previous physical health and medication, is likely to aid the general practitioner to reach this diagnosis in many cases. Depression is suggested by evidence from informants about lowered mood, diminished appetite and disturbed sleep. An association between level of education and mini-mental state examination score has been found[9] but our study suggests that educational disadvantage, at least as reflected by social class, has a small effect on this score.

Previous studies have found that general practitioners under diagnose dementia,[2,10] and our results confirm this tendency to under diagnose dementia among those subjects whose mini-mental state examination scores are in the 'possibly demented' (19–24) and 'probably demented' (0–18) ranges. However, this must be qualified by noting that general practitioners may not always record a suspicion of dementia as a firm diagnosis in the patient's medical record. Nevertheless, the identification of a significant number of demented elderly patients is likely to have workload implications for general practitioners who attempt to mobilize necessary support services, particularly in the first year of assessment, when a backlog of previously undiagnosed cases will be dealt with. Documentation of referrals to other agencies, and responses from those agencies, would be a worthwhile addition to the task of 'mental assessment'. A small proportion of cases (0.7%) were incorrectly diagnosed as suffering from dementia by their general practitioner, a similar proportion to that found by O'Connor and colleagues.[2]

The mini-mental state examination is straightforward to complete and is suitable for use by both medical and non-medical interviewers after training. It takes on average 10 minutes to administer, and so case finding or screening for cognitive impairment using the mini-mental state examination in an average practice with around 130 patients over the age of 75 years would take a minimum of 22 hours per year, not including travelling time and time needed to further assess those 17 with low mini-mental state examination scores. In our study the mini-mental state examination plus basic questions about known major medical problems, household size and the extent of the individual's support network took an average of 25 minutes to administer, which if applied to an average practice would require 54 hours face-to-face contact each year. The full assessment as required by the contract would, however, take considerably more time than this, and it seems likely that the time needed to arrange interviews with those who were not at home, for travelling and for paperwork could exceed that spent on assessment.

Our results suggest that the mini-mental state examination is acceptable to patients and feasible for use by trained non-medical staff for the detection of cognitive impairment in general practice populations. The annual 'mental assessment' required under the new contract will require at least two visits for about 13% of patients, the first a screening visit by a suitably trained practice worker and the second a diagnostic visit by a general practitioner. The workload implications of this new contractual obligation do not appear to have been quantified, and a standard capitation fee for patients aged over 75 years may not adequately reflect the extra workload which may result from the marked increase in cognitive impairment which occurs in the very elderly.

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