REVIEW

Screening for dementia in primary care: a review of the use, efficacy and quality of measures

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ABSTRACT

Background: Despite evidence that early identification of dementia is of growing policy and practice significance in the U.K., limited work has been done on evaluating screening measures for use in primary care. The aim of this paper is to offer a clinically informed synthesis of research and practice-based evidence on the utility, efficacy and quality of dementia screening measures.

Method: The study has three elements: a review of research literature, a small-scale survey of measures employed in three primary care trusts, and a systematic clinical evaluation of the most commonly used screening instruments. The study integrates data from research and clinical sources.

Results: The General Practitioner Assessment of Cognition (GPCOG), the Memory Impairment Screen (MIS), and the Mini-Cognitive Assessment Instrument (Mini-Cog) were found to be brief, easy to administer, clinically acceptable, effective, and minimally affected by education, gender, and ethnicity. All three have psychometric properties similar to the Mini-mental State Examination (MMSE).

Conclusions: Although the MMSE is widely used in the U.K., this project identifies the GPCOG, MIS and Mini-Cog as clinically and psychometrically robust and more appropriate for routine use in primary care. A coherent review of evidence coupled with an indepth evaluation of screening instruments has the potential to enhance ability and commitment to early intervention in primary care and, as part of a wider educational strategy, improve the quality and consistency of dementia screening.

Introduction

Dementia is a major cause of disability amongst older people and constitutes one of the most serious, and expensive, challenges currently facing health and social care services in the developed world. About 775,000 people currently have dementia in the U.K. and this figure is projected to rise to over 1.7 million by 2050 (Alzheimer's Society, 2007). Over the last decade increasing emphasis on policy and practice has been placed on early intervention in the care and treatment of people with dementia (Department of Health, 2001). This has been accompanied by a focus on the pivotal role of primary care staff, particularly general practitioners (GPs), in dementia screening (Care Services Improvement Partnership, 2005). Despite evidence that early recognition may be of growing clinical significance to GPs and that inadequate detection denies people with dementia optimal care, limited work has been done on the value and efficacy of screening measures (Milne *et al.*, 2005). Furthermore, policy-related guidance explicitly recommends the use of standardized screening measures but provides limited advice about which instruments to employ (National Institute for Health and Clinical Excellence and Social Care Institute for Excellence, 2006).

Inadequate detection of dementia in primary care has been documented nationally in the U.K. (National Audit Office, 2007) and internationally (Ashford *et al.*, 2006). Failure rates have been estimated at between 50% and 80% for moderate to severe dementia and up to 91% for mild cases (Boustani *et al.*, 2005). In the U.K. more than half of all those with dementia never receive a diagnosis (House of Commons Committee of Public Accounts, 2008). The proportion of GPs who regularly screen in Australia has been estimated at 39% (Brodaty *et al.*, 1994) and in Canada at 26% (Valcour *et al.*, 2000). In part, these figures reflect the problematic nature of dementia screening and diagnosis in terms of its uncertain etiology and psycho-pathology and its high variability in symptoms and signs. They also reflect an absence of suitable validated instruments, limited training in screening, mixed availability of specialist services and unclear referral pathways (Alzheimer's Society, 2007). Those who do use a screening instrument, notably the Mini-mental State Examination (MMSE), consider that it is "too long" for use in general practice, its scores are too difficult to interpret and it shows cultural and educational bias (Folstein *et al.*, 1975; Boise *et al.*, 1999).

The fact that dementia constitutes only a very small – albeit increasing – part of the total caseload of a GP is also significant. In a typical U.K. Primary Care Trust population of 250,000 there will be 45,000 people (18%) who are aged 65 and over. Of these 2,250 will have dementia and 700 will have stroke-related cognitive deficits (Care Services Improvement Partnership, 2005). National morbidity statistics from general practice show that dementia is associated with an annual incidence of 1.6 new patients per GP and a workload of 7.4 consultations (Royal College of General Practitioners, 1995). Once diagnosed, patients with dementia become long-term and regular users of primary care services (England, 2006). The other important characteristic of UK primary care is the 7.5-minute estimated length of consultation.

The aim of this paper is to offer a clinically informed synthesis of research and practice-based evidence on the utility, efficacy and quality of dementia screening

measures for use in primary care in the U.K. It draws on findings from a three-part study – the "Dementia Screening Project" – conducted in 2005/06 which combined concurrent evidence from a literature review, a small-scale survey of dementia screening and a clinically driven rating exercise of commonly used measures. It focused on tests administered to patients in a face-to-face situation as this mirrors the setting under review (Iliffe *et al.*, 2002).

Dementia screening instruments: review of research evidence

The aim of the literature review is to summarize research evidence relating to screening instruments in the U.K., and where appropriate, North America and Australia.

The literature search was carried out using the electronic databases MEDLINE, PsychINFO, PSYCHLIT and the Cochrane Library Database (covering the period 1990–2006). All searches were limited to English language articles reporting development, validation or psychometric properties of dementia screening instruments. The key words "dementia" or "cognitive impairment" combined with "screening" or "diagnosis" were used. Papers that reported the use of the instruments in primary care were prioritized.

Although the need for an overarching review of instrument efficacy has been identified, most reviews focus on individual scales. There are two exceptions: a review by Lorentz and colleagues in 2002 which set out to compare brief screening tests for dementia for routine use in primary care and a 2006 study by Brodaty *et al.*

The review by Lorentz *et al.* (2002) selected screening tests that met two criteria: administration time of 10 minutes or less in studies including individuals with, and without, dementia; and performance characteristics evaluated in at least one community or clinical sample of older adults. The authors compared tests for: face validity, sensitivity and specificity in a clearly defined subject sample; vulnerability to sociodemographic biases unrelated to dementia; direct comparison with an accepted standard; acceptability to patients and doctors; and brevity and ease of administration, scoring and interpretation by non-specialists. Thirteen instruments met their criteria; of these, only three tests showed promise for broad application in primary care – the General Practitioner Assessment of Cognition (GPCOG), the Memory Impairment Screen (MIS), and the Mini-Cognitive Assessment Instrument (Mini-Cog).

The review by Brodaty *et al.* (2006) built on the more general paper by Lorentz *et al.* (2002) by reviewing screening tools with a view to informing and recommending usage to GPs. It draws widely on work from the U.S.A., U.K. and Australia as well as on a large-scale survey of Australian GPs and offers a thorough review of screening instruments based on their performance and 'suitability for purpose'.

Inclusion criteria for the review of Brodaty *et al.* (2006) were that instruments had to be validated in a community, population or general practice sample; be simple to administer; have an administration time of 5 minutes or less; have a misclassification rate numerically the same as, or less than, the MMSE; and

have a negative predictive validity (NPV) the same as, or less than, the MMSE (positive predictive value was not considered because all values were generally low and were dependent on prevalence). Eighty-three full-text articles were obtained generating summaries of 16 instruments: 7 Minute Screen; Short Form of the IQCODE ; Abbreviated Mental Test Bowles-Langley Technology/Ashford Memory Test (AMT); Cambridge Cognitive Examination; the Clock Drawing Test (CDT) scored using the 10-point scale; MIS; Mental Alternation Test; Mini-Cog; MMSE; Short and Sweeting Screening Instrument; Short Test of Mental Status; the 6-Item Cognitive Impairment Test (6CIT); the GPCOG; the Rowland Universal Dementia Assessment; and the Time and Change Test. Overall rates of sensitivity ranged from 64.8% to 100%, specificity from 81% to 93.3% and negative predictive values from 91.1% to 99.2% (Wind *et al.*, 1997).

Of the 16 instruments that fulfilled the inclusion criteria only four were validated within primary care settings: the MMSE, GPCOG, CDT and 7 Minute Screen. Only three had a misclassification rate the same or less than the MMSE (15%), the GPCOG, Mini-Cog and MIS (Ashford *et al.*, 2006). They also had high sensitivity and specificity ($\geq$ 80%) and were reported to be quick and easy to administer. Despite a difference of approach from Lorentz *et al.* (2002), Brodaty *et al.* (2006) identified the same three instruments – GPCOG, Mini-Cog and MIS – as the most suitable for dementia screening in general practice.

A third paper by Holsinger *et al.* (2007) complements – and challenges – earlier work by offering a review of the "practicality and accuracy" of brief screening instruments in primary care. Whilst the authors view the GPCOG as "promising" they consider that it has not been sufficiently studied to make confident claims; they also postulate that as the Mini-Cog has not been administered in its "suggested form," its performance cannot be determined. The paper concludes that in circumstances where a "very brief instrument" is required the MIS or a scored clock test are the most effective. However, the authors acknowledge that sensitivity of the CDT to mild forms of impairment is low; also, clocks need to be scored appropriately.

Small-scale survey

The second dimension of the project was a small-scale postal survey of whether – and if so, which – screening instruments were used in primary care practices in Kent in south-east England. The area is made up of three Primary Care Trusts covering a total area of 1,537 square miles with a population of 1.7 million. It is characterized by pockets of urban development surrounded by farmland. The survey of primary care practices (not of individual practitioners) within this area was conducted early in 2006 as part of a practice audit. The intention was to collect baseline data on dementia screening to monitor changes over time (Culverwell *et al.*, 2006). Each practice was asked to mark which measures they used from a list of frequently used instruments. Unlisted measures could be added and supplementary commentary was invited.

Findings

The overall response rate to the survey was 53% (138 of 260 practices). Of the total sample, 79% reported that they use at least one dementia screening instrument, with 21% not using an instrument at all. Of those who use an instrument, 70% of practices use one, 26% use two and only 4% use more than two

The breakdown of instruments used is as follows: 51% employ only the MMSE, 11% use the AMT and 10% the AMT and MMSE; 8% use the MMSE and CDT; 6% use the MMSE and 6CIT and 5% use the CDT. 1% used 6CIT alone and 2% use "another tool" (see Figure S1, available as supplementary material attached to the electronic version of this letter at www.journals.cambridge.org/jid_IPG).

There was very little difference between the three primary care trusts (see Figure S2, available as supplementary material attached to the electronic version of this letter at www.journals.cambridge.org/jid_IPG). This suggests that the pattern of usage is more likely to be mirrored in areas other than the one being surveyed.

Some 40.5% (56 of 138) of respondents made "additional comments." Key issues raised were: the limited availability of measures other than MMSE, a need for information about the full range of instruments, greater access to training and advice on screening, and national guidance. One GP summarized the views of many thus: "It would be very helpful if a standard screening tool could be recommended and made widely available . . . now!"

Key themes

Overall, the survey suggests that over half (53%) of responding practices use at least one dementia screening tool. In terms of instrument type, the MMSE dominates with 80% using it either alone or alongside at least one other – primarily the CDT, AMT or 6CIT. Comments strongly suggest that practices feel constrained and tend to rely disproportionately on the MMSE. Whilst it is difficult to say from this "snapshot" what this constraint constitutes, it would appear that limited access to training and lack of information about measures coupled with minimal guidance serve to undermine GPs' ability to screen with confidence.

The survey findings indicate a need for further work to support the development of consistent practice in primary care, a part of which should be advice about the available measures. As the sample represented over half the area's practices and there is nothing to suggest that this area is atypical, these findings can be considered more widely representative (Milne *et al.*, 2000). However, as with all findings from brief postal surveys, they tend to be limited in breadth and depth (Bowling, 2002).

Clinical rating exercise of dementia screening instruments

The clinical rating exercise of the most commonly used screening instruments in the UK constitutes the third element of the study. It is important to note that

it was conducted before publication of the U.K. Guidance in 2006: *Supporting People with Dementia and their Carers* (National Institute for Health and Clinical Excellence and Social Care Institute for Excellence, 2006), and prior to the reviews of both Brodaty *et al.* (2006) and Holsinger *et al.* (2007). The measures subject to evaluation were chosen by the twin processes of evidence emerging from the literature review and survey, and the working knowledge of team members.

To be included in the exercise measures had to be: designed to screen for early signs of cognitive change amongst older people presenting to primary care; appropriate for use in the U.K.; and sufficiently quick to be administered within the normal GP consultation time. The rating exercise was conducted in three stages: the development of evaluation criteria; a review of evidence for each instrument; and the rating process itself.

Evaluation criteria

The criteria were developed drawing on work by the British Psychological Society (BPS) on outcome measures. Of particular relevance is a 2004 report entitled "Measuring psychological treatment outcomes with older people", which developed a set of criteria against which to assess clinical measures (Sperlinger *et al.*, 2004). These criteria were revised for use in this project taking account of the target population, research literature and the specific nature of the instruments.

Sixteen criteria were grouped into four key domains:

1. Practicality (three criteria): amount of time it would take for clinicians to familiarize themselves with the measure; cost of the instrument; and availability.
2. Feasibility (six criteria): acceptability to patients; acceptability to clinicians; difficulty of administration; ease of scoring; length of time required to complete; and ease of interpreting scores.
3. Range of applicability (four criteria): applicability to a wide age range; sensitivity to different educational levels; sensitivity to language and culture; applicability to different types of dementia.
4. Psychometric properties (three criteria): validity and reliability; specificity; and sensitivity.

The criteria were rated on a five-point scale reflecting approaches taken in similar work (McDowell and Newell, 1996). As there are four domains, the maximum score that a single instrument can achieve is 20. The criteria were developed, quite independently, of those used by Lorentz *et al.* (2002) although there is some (perhaps inevitable) overlap.

Review of evidence for individual instruments

The team originally selected 11 instruments that met the inclusion criteria: MIS; Mini-Cog; MMSE; AMT; CDT; 6CIT (Brooke and Bullock, 1999); GPCOG; Short Portable Mental Status Questionnaire (SPMSQ) (Erkinjuntti

et al., 1987); Seven Minute Screen (7 Minute Screen) (Meulen *et al.*, 2004); the Cognitive Capacity Screen Examination (Jacobs *et al.*, 1997); and the Short Cognitive Performance Test (SKT) (Lehfeld and Erzigkeit, 1997). The MMSE was included despite its administration taking more than 7.5 minutes due to its widespread use and its being the "reference point" of much research in this field.

During the first stage of the review three instruments were de-selected: the 7 Minute Screen because it is too long (it actually takes about 12 minutes to complete) and too complex to administer and score (scoring requires the use of a special calculator formula which, although available on the web, takes time to learn, use and embed into practice), and the Cognitive Capacity Screen Examination because its focus is on medical patients rather than those with a possible psychiatric illness (Solomon *et al.*, 1998). Further, there is no evidence of its use in the U.K. The SKT was de-selected because it is not a dementia screen but an instrument which specifically assesses deficits in memory and attention; it is also prohibitively expensive and complex to score.

Literature specific to each of the eight remaining instruments (see Appendix 1 for a short description of each) was reviewed and collated, using material that emerged from the broader review of literature. Evidence on the performance, strengths and weaknesses of each instrument was distilled and tabulated (see Table 1).

Rating process

The three clinical team members systematically and independently evaluated each instrument, filtering the collated research evidence through the lens of clinical utility. The evidence was then converted into ratings for each domain for each instrument. The ratings were discussed within the team and consensus reached on final scores (see Table 1). Finally – and similar to Lorentz *et al.* (2002) – a three integer scale was developed for each of the 16 criteria.

Table 1 offers a numerate score for each domain which, when combined, provides an overall score (out of 20) for each instrument; this is supplemented by a non-numerate scaled rating for each of the 16 criteria. Particular issues with specific instruments are also highlighted. This exercise has not previously been attempted in the U.K. context; nor has existing work in this field employed a clinical focus of analysis. Table 1 thus offers a thorough, yet accessible, evidence-based summary of the outcomes of the evaluation process.

Outcome

The three screening measures that were rated as best overall were the GPCOG (score of 16), the Mini-Cog (16) and the MIS (15); these were followed by the SPMSQ, the 6CIT, the AMT and the CDT. Although the MMSE, AMT and CDT are easily available, this is not the case for the other five instruments; the 6CIT is penalized by the paucity of evidence about its use. Most instruments are cost free. Whilst the balance of evidence varied between, and within, the criteria, the combined ratings for each reflect the measure's overall clinical utility, efficacy and quality.

Table 1. Dementia screening instruments: clinical rating table

	AMT	CDT	GPCOG	MINICOG	MIS	MMSE	SPMSQ	6CIT
Practicality	5	5	4	3	3	3	4	4
Familiarization time very short/short/ moderate	V. short	V. short	Short	V. short	V. short	Short	V. short	Short
Cost (1) none/small/moderate	Small (£18 fee for original paper)	None	None	None	None	Moderate ($1 per use of MMSE)	None	None
Availability (2) easily available/available/ less easily available	Easily available	Easily available	Available	Less available	Less available	Easily available	Available	Available
Feasibility	4	2	5	5	4	2	3	4
Acceptability to users Yes/some difficulties/not acceptable	Some difficulties	Yes	Yes	Yes	Yes	Some difficulties	Yes	Yes
Acceptability to clinicians Yes/some difficulties/not acceptable	Yes	Yes	Yes	Yes	Yes	Some difficulties	Yes	Yes
Difficulty of administration Easy/a few difficulties/ a number of difficulties	Easy	A few difficulties (3)	Easy	Easy	Easy	A few difficulties	Easy	Easy
Ease of scoring Easy/some difficulties/ difficult	Easy	Some difficulties (4)	Easy	Easy	Easy	Some difficulties	Easy	Some difficulties
Completion time (5) very short/short/ longer (+ actual estimated time)	Short (4–6 mins)	V. short (>2 mins)	Short (4–5 mins)	V. short (2–4 mins)	Short (4 mins)	Longer (10 mins)	V. short (3–4 mins)	Short (4–6 mins)
Score interpretation Easy/a few difficulties/ difficult	Easy	A few difficulties (6)	Easy	Easy	Easy	Difficult	A few difficulties	Easy
Range of applicability	2	3	3	4	4	2	3	3
Applicable to wide age range yes/to some degree/no	Yes	To some degree	To some degree	To some degree	Yes	To some degree	Yes	Yes
Different educational levels yes/to some degree/no	To some degree	Yes	To some degree	Yes	Yes	To some degree	Yes	To some degree
Language & cross culture yes/to some degree/no	To some degree	Yes	No evidence	Yes	Yes	To some degree	To some degree	To some degree

Different types of dementia yes/to some degree/no	No	To some degree	Yes	Yes	To some degree	To some degree	To some degree	To some degree
Psychometric properties (7) (8)	3	4	4 (9)	4	4	3	4	3
Validity & reliability (10) high/adequate/low	Low/adequate	Adequate	Adequate	Adequate	Adequate	Adequate	High	Limited evidence
Specificity (11) high/adequate/low	High	High	High	High	High	High	High	High
Sensitivity (12) high/adequate/low	Adequate	High	High	Adequate	High	Low	Adequate	Adequate
TOTAL	14	14	16	16	15	10	14	14

(1) None = no cost, only copyright/acknowledgement of authorship is required; small cost = one off copyright payment or payment for article it first appeared in; moderate cost = payment each time the instrument is used.

(2) Easily available – the screen is available in the practice and can be accessed in a matter of minutes; Available = can be downloaded from the internet easily, i.e. can be googled; Less available = the screen is embedded in a website or a paper or cannot be easily located via Google.

(3) These ratings reflect the confusion that can arise as a result of the multiple versions of the CDT that exist each with their own administration and scoring system.

(4) These ratings reflect the confusion that can arise as a result of the multiple versions of the CDT that exist each with their own administration and scoring system.

(5) Very short = up to 4 minutes; short = 4–6 minutes; longer = more than 6 minutes.

(6) These ratings reflect the confusion that can arise as a result of the multiple versions of the CDT that exist each with their own administration and scoring system.

(7) Evidence relating to the psychometric properties is derived from research literature.

(8) As the NPV for all the instruments ranges from 0.92 to 1.00 (except for the Short Portable Mental Status Questionnaire for which evidence does not exist) it was not included as a separate psychometric property.

(9) Evidence relating to the psychometric properties for the GPCOG is derived from research than includes both user and informant data

(10) Validity and reliability have a composite score as both dimensions of a screening instrument have to be at least adequate for clinical purposes.

(11) 70 or below = low, 71–79 = adequate, 80 and above = high.

(12) 70 or below = low, 71–79 = adequate.

AMT = Abbreviated Mental Test; CDT = Clock Drawing Test; GPCOG = General Practitioner Assessment of Cognition; MINICOG = Mini Cognitive Assessment Instrument; MIS = Memory Impairment Screen; MMSE = Mini-mental State Examination; SPMSQ = Short Portable Mental Status Questionnaire; 6CIT = 6-item Cognitive Impairment Test.

Note: This article has online supplementary material please see journals.cambridge.org/ipg

Discussion

Four sets of overarching findings emerge. First, both the literature review and the clinical evaluation arrive at the same conclusion – namely, that the GPCOG, MIS and Mini-Cog meet all, or most, of the requirements of a primary care screening instrument. All three screens include a test for short-term memory, display good-to-excellent psychometric properties, and require 5 minutes or less to administer. Relative to the well-established standard of the MMSE, two of the three tests – Mini-Cog and GPCOG – have been shown to perform just as well (GPCOG in a clinical sample and Mini-Cog in an epidemiological sample) or significantly better (Mini-Cog in a multi-ethnic sample). They also have the additional advantage of relative freedom from bias by educational attainment (Mini-Cog and MIS) or language and culture (Mini-Cog) (Parker and Philp, 2004; Harvan and Cotter, 2006). For two of the instruments – the AMT and the MMSE – there are cost considerations which may act as a disincentive to usage. Note that none of the three reviews referred to above regarded cost to be a consideration. Although the use of some dementia screening instruments may require copyright agreement, this is not the case for any of the eight instruments in Table 1 so long as they are used for "clinical or research purposes." However, this situation may change and, for new instruments, this may become an issue.

Secondly, the clinical evaluation process identified the GPCOG, MIS and Mini-Cog as being of practical value, feasible to use in primary care settings and as having wide applicability. That the clinicians who rated the instruments are very familiar with dementia screening, routinely train and work with primary care staff and are aware of the time and administrative constraints this setting presents, adds credibility to the project's findings (Sperlinger *et al.*, 2004). Its focus on the U.K. context also marks it apart. The systematic iterative approach to the evaluation process is an additional strength. Further support can be found quite independently in the 1994 study by Brodaty *et al.* in Australia (discussed in their 2006 review paper) where they found that these three instruments were *acceptable* to GPs. It is anticipated that the summary contained in Table 1 should be of direct value to primary care staff who are given the task of dementia screening; it may also be of value to secondary care practitioners and older people themselves (Iliffe and Manthorpe, 2004).

Thirdly, the project found that, among GPs who use an instrument, a disproportionate number rely on the MMSE. This appears to be largely for reasons of availability and professional "habit"; its prominence in policy guidance is also a factor (National Institute for Health and Clinical Excellence and Social Care Institute for Excellence, 2006). That it is the subject of increasing criticism suggests that alternatives should be made more accessible. The influences of age, educational levels and social class on MMSE scores are well documented (Brayne *et al.*, 1998). A further concern is a recent suggestion that its widespread usage may result in users "learning" appropriate responses.

A fourth finding is that an uneven pattern of screening for people with dementia in primary care exists locally, nationally and internationally. A need for consistency in screening is widely identified, as well as a need for information and

advice on screening instruments (National Audit Office, 2007). The GPCOG, Mini-Cog and MIS appear likely to be preferable to the MMSE if GPs and other primary care staff are given training in screening, and if easily accessible and user-friendly software for desktop computers is made available (Turner *et al.*, 2003; 2004). Drivers for addressing current deficits are the facts that training in dementia management in primary care is efficacious and that routine screening could improve the number and quality of referrals to secondary care (National Audit Office, 2007). Evidence that nurse screening (for nurses and primary care visitors) is both accurate and cost effective is also relevant, as is the proposal for sub-specialization within the new contract for GPs (Seymour *et al.*, 1994).

Limitations

The project has a number of limitations. The survey is small scale and as such its findings may not be representative. The research literature is uneven in quantity and quality; there is a limited amount of evidence about some instruments e.g. the 6CIT, and for others, about their use in the UK e.g. the GPCOG. The clinical rating exercise could be criticized for not statistically weighting either the dimensions or the quality of evidence. As this is a fast evolving field, very recent work on refinements to instruments may not have been included. A notable example relates to the MIS. Evidence of a significant improvement to the sensitivity of the instrument for the identification of very early stage dementia – entitled the MIS-D – has recently been published (Vernooij-Dassen *et al.*, 2005). Whilst the MIS-D takes more than 10 minutes to administer and, on these grounds, would have been excluded from this project, it appears clinically relevant and is a positive addition to the portfolio of instruments. The absence of a GP from the review team may also be considered a limitation.

From a methodological perspective, it is important to acknowledge the role of modern test theory – notably Item Response Theory – in subjecting instruments to more robust statistical analysis than has been the case for the measures reviewed in this paper (Kraemer, 1992; Mendiondo *et al.*, 2003). That these have the potential to contribute to the development of even shorter, more efficient screening instruments is particularly valuable; it is an issue which future research needs to accommodate.

Although the MIS, GPCOG and Mini-Cog are rated as best overall, specific individual strengths make one or other more suitable for use in particular contexts. The MIS, for example, is especially appropriate for use with black or minority ethnic populations but is limited in its range of applicability by virtue of its reliance exclusively on a verbal memory test (Parker and Philp, 2004). The GPCOG, by virtue of the informant section, is particularly useful in providing a starting point, when relatives report concerns but the patient is not present.

Future work

The project highlights a number of areas for future work. The GPCOG should be further investigated for its potential language or cultural bias and the Mini-Cog and MIS investigated to ascertain their level of GP and user satisfaction. Further,

computerized versions of all three instruments need to be made available as desktop programs and subjected to systematic evaluation such as longitudinal monitoring. A key aspect of evaluation should address the "cost worthiness" of screening. Although existing evidence – albeit limited – on the health economics of screening tends to support it, considerably more work is needed (Fillit *et al.*, 2006). The authors also recognize that whilst a clinically informed evaluation of instrumentation is key to improving dementia screening, its potential is best realized as part of wider guidance and training on the management of dementia in primary care and as a pivotal "first step" in a care pathway which incorporates specialist diagnostic provision and follow-up treatments (Maeck *et al.*, 2007; Ashford *et al.*, 2007).

Appendix 1: Overview descriptors of the eight screening measures in Table 1

Note: These brief descriptions must *not* be mistaken for guidance on the use of the instrument in screening for dementia. Key references offer this depth of information.

Abbreviated Mental Test (AMT)

The AMT consists of 10 items of varying complexity, each scored as one point if answered correctly, with 7 or 8 used as cut-off for diagnosing impairment. There are only verbal items. Orientation, long term memory, recognition and short term memory are assessed. There is no further evaluation of perceptual problems or of frontal and executive functions (Hodkinson, 1972).

Clock Drawing Test (CDT)

All methods of administration require the client to draw a clock face reading a specified time – either by firstly drawing a circle free hand, or within a pre-drawn circle. There are multiple scoring systems ranging from a simple binary rating (normal or abnormal) to complex quantitative and qualitative systems. The lack of a universal method of administration and scoring leads to difficulties in the interpretation. Spatial and executive function are assessed but there is no test of memory (Shulman, 2000; Kirby *et al.*, 2001).

General Practitioner Assessment of Cognition (GPCOG)

The GPCOG includes the following items: time orientation, a clock drawing task, report of a recent event and a word recall task. Scoring requires summing correct responses. In addition to the client assessment, this measure has the option of an additional set of 6 questions asked of an informant who has known the subject over a number of years. These items ask about changes that have been noticed in comparison with a 'few years ago' (Brodaty *et al.*, 2002).

Memory Impairment Screen (MIS)

This measure comprises a verbal memory task with a specific encoding procedure. Scoring is done by hand using a simple equation based on the

number of correctly recalled items. Cut-off scores are available for populations with varying base rates, PPV and sensitivity/specificity ratios. There is no direct test of executive function or visuo-spatial skills (Busche *et al.*, 1999; Kuslansky *et al.*, 2002).

Mini Cognitive Assessment Instrument (Mini-Cog)

This measure includes a verbal memory task and a clock drawing test. Scoring is performed by hand and involves scoring the clock drawing according to simple specified criteria and summing the number of correctly recalled items. An algorithm combining both the memory test and clock drawing results clarifies intermediate scores (Borson *et al.*, 2000; 2006).

Mini-mental State Examination (MMSE)

The MMSE measures orientation, immediate memory, attention and calculation, recall, various aspects of language and visuo-spatial skills. It offers cut off scores for mild, moderate and severe dementia. A person's score can be affected by age, education, culture and language (Folstein *et al.*, 1975; Burns *et al.*, 2004). There are no direct tests for occipital or frontal lobe problems.

Short Portable Mental Status Questionnaire (SPMSQ)

The SPMSQ consists of 10 items of varying complexity. The clinician counts the number of errors made, which indicate the level of cognitive impairment. A table is available for guidance. The items are similar to the Abbreviated Mental Test (AMT), verbally based only, and mainly based on orientation in time, place and person. Long term memory and attention/ concentration are also assessed. There is no direct test of short term memory and there are no items covering right hemisphere, occipital or frontal lobe problems (Erkinjuntti *et al.*, 1987).

6-Item Cognitive Impairment Test (6-CIT)

Also called the Short Orientation-Memory-Concentration Test and the Short Blessed Test. Errors are counted and weighted as per instruction and levels of impairment established according to a guide line. All items are verbally based. Orientation, short term memory and attention/concentration are assessed. There are no items to detect perceptual or visuo-spatial problems or any executive function difficulties apart from sequencing (Brooke and Bullock, 1999; Parker and Philp, 2004).

Conflict of interest

None.

Description of authors' roles

Alisoun Milne provided research and academic support to the project; Alison Culverwell, Reinhard Guss and Jackie Tuppen conducted the clinical evaluation

of the instruments and Beckie Whelton helped with survey data analysis. The idea for the project grew out of shared academic and clinical concerns that insufficient guidance and advice is provided to primary care staff about dementia screening.

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