The Use of Brief Screening Instruments for Age-related Cognitive Impairment in New Zealand

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This study aimed to determine which measures are most commonly used to screen for age-related cognitive impairment in New Zealand, to describe how and why they are used, determine the factors clinicians deem most important in the selection of a particular screen, and their levels of training and expertise in using particular screens. A web survey was completed by geriatricians, neurologists, psychiatrists, and psychologists (*N*=82). Cognitive screening measures were selected for the survey based on previous research. According to the sample, the most frequently used screen was the Mini-Mental State Exam (MMSE), followed by the Clock Drawing Test (CDT), and Addenbrooke's Cognitive Examination Revised (ACE-R). Cognitive screening fulfilled a variety of functions in clinical practice and was widely used, especially in services for older people, however formal training was limited. Availability, reliability and validity, and brevity (respectively) were the most important factors clinicians considered when selecting a screening instrument. Respondent comments agreed with current literature that the MMSE is inadequate as a screening instrument for cognitive impairment, and this was reflected in the comments of respondents on the survey questionnaire, yet this was still the most commonly used measure in New Zealand.

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It is widely recognised that the ratio of older adults in the general population of Western societies is growing rapidly. This international trend is also seen in New Zealand where the number of people aged 65 years and older has increased by 86.4% between 1971 and 2001 (Statistics New Zealand, 2002), and it is estimated that the rate of older people in the total population will grow to 25.5% over the next 44 years, up from 12% in 1999 (Statistics New Zealand, 2000). As cognitive impairment is highly correlated with age (Gao, Hendrie, Hall, & Hui, 1998), the absolute number of people presenting with cognitive complaints is therefore likely to increase exponentially within the next few years with a corresponding increase in the need for assessment and management of these complaints.

Cognitive screening is typically conducted by general practitioners, neurologists, psychiatrists, geriatricians, and psychologists as a precursor to, or as part of, comprehensive clinical assessment of cognitive impairment (Cullen, O'Neill, Evans, Coen, et al., 2007). In addition, screening instruments monitor change over time and assists in ongoing clinical decision-making. Early detection of cognitive impairment maximises the opportunity to put in place compensatory strategies useful as cognitive status deteriorates (Hachinski, 2008).

Previous overseas surveys (Reilly, Challis, Burns, & Hughes, 2004; Shulman, Herrmann, Brodaty, Chiu, Lawlor, et al., 2006) found that the screening measure most commonly used internationally was the Mini-Mental State Exam (MMSE; Folstein, Folstein, & McHugh, 1975), followed by the Clock Drawing Test (CDT; Shulman, Shedletsky, & Silver, 1986), the Middlesex Examination of Mental State (MEAMS; Golding, 1989), Cambridge Mental Disorders of the Elderly Examination (CAMDEX; Roth, et al., 1986)), CDT and Delayed Word Recall (Mini-Cog; Borson, Scanlan, Brush, Vitaliano, & Dokmak, 2000), Verbal Fluency Test (FAS; Bechtoldt, Benton, & Fogel, 1962), Similarities (Wechsler, 1997), and the Trail Making Test (Reitan, 1958). While Similarities is not a stand-alone screening instrument, the study by Shulman et al., (2006) had included it as a task commonly used for screening purposes.

It is unclear which cognitive screening instruments are most frequently used in New Zealand and clarification of this is one focus of the current study. Anecdotal reports from clinicians had suggested that the MMSE was also used extensively in New Zealand, although there were concerns regarding its validity. These concerns were based on clinical observations of the MMSE's relative insensitivity to the milder forms of dementia and research literature examining the validity and utility of the MMSE in a variety of contexts (Anderson, Sachdev, Brodaty, et al., 2007; Bak & Mioshi, 2007; (Cullen, O'Neill, Evans, Coen, et al., 2007).

The MMSE was developed in the

1970's and was based on a unitary, global understanding of dementia (Bak & Mioshi, 2007), a view that has radically changed over time. Whereas dementia was conceived of as a global deterioration of cognitive function, it is currently understood as encompassing a number of neurological conditions with divergent patterns of cognitive impairment (Lezak, Howieson, & Loring, 2004).

The MMSE, as a measure of global impairment, is therefore inadequate for detecting various disorders within the dementia spectrum. Moreover, it virtually ignores the frontal-executive, visuospatial, and semantic memory domains which are affected in disorders such as fronto-temporal dementia, Parkinson's disease, progressive supranuclear palsy, cortico-basal deterioration, and right-hemispheric stroke (Bak & Mioshi, 2007). Further, a number of studies have shown the MMSE to be biased according to age, education, gender, socio-economic status, culture, language and ethnicity, test location, and test repetition (Anderson, Sachdev, Brodaty, et al., 2007; Black, Espino, Mahurin, et al., 1999; Riddha & Rossor, 2005)

The current study extends previous surveys (Reilly, et al., 2004; Shulman, et al., 2006) of the use of cognitive screening measures in geriatric settings by determining what clinicians looked for in a screen, the role of screens in clinical practice, clinicians' levels of competency and training, and their attitudes toward the current issues in cognitive screening. The objective of the current study was to investigate the current use and role of cognitive screens in New Zealand geriatric services, the current needs and attitudes of New Zealand clinicians regarding the use of cognitive screens, and to compare practice in New Zealand with overseas.

Method

Participant recruitment

Potential participants were initially those working in all clinical areas involved in all adult cognitive screening such as dementia, electroconvulsive therapy, depression, brain injury and other forms of brain damage. Participants were recruited via the professional bodies of the targeted occupational groups - the Royal Australian and New Zealand College of Psychiatrists (RANZCP), the Australian and New Zealand Society of Geriatric Medicine (ANZSGM), the Neurology Association of New Zealand (NANZ), and the New Zealand Psychology of Older People (NZPOPs) group.

The RANZCP consists of 610 New Zealand members, of whom 327 are active Fellow members, 143 are associate members (trainees) and 140 are Affiliate members (The Royal Australian and New Zealand College of Psychiatrists, 2011). The ANZSGM had 134 active NZ members, NANZ had 50 neurologist members, and NZPOPS had 59 full members at the time of the survey.

In consultation with executive members of the RANZCP, it was agreed to publish a research notification in their online bulletin, which invited psychiatrists to participate in the online survey, hosted by the Massey University website. Similar consultation with the ANZSGM and NANZ resulted in email invitations being sent to each of their individual New Zealand members that included the same live web-link to the online survey. Follow-up email reminders were sent out approximately three weeks later. The RANZCP did not agree to send individual email invitations as with ANZSGM and NANZ, and this may have biased the representativeness of the sample.

At this stage the study design was adapted to focus on cognitive screening measures used with older adults, and further recruitment efforts targeted clinicians working with older adults. The researcher gained permission and access to the NZPOPs mailing list and sent a similar email invitation to each of their members. The email invitation to NZPOPs members was preceded by an introductory email by one of the heads of the NZPOPs group and a presentation of the research project at the NZPOPs annual conference by the first author. The email invitation followed soon after. A follow-up reminder email was sent out a week later to the POPs group as the survey was drawing to a close. In an effort to further increase the participation rate of geriatric psychiatrists, a clinician in the field re-invited psychiatrists on his mailing list, requesting their participation if they had not already done so.

The Questionnaire

The list of screening measures to be rated was taken initially from the review by Cullen, O'Neill, Evans, Coen, et al. (2007). This study reviewed a number of screening instruments and included some neuropsychological tasks (such as FAS, TMT, and HVLT) that are often used in brief screening assessments. While not the specific focus of the current survey, these were included in order to maximise comprehensiveness and enable comparison with previous surveys (Reilly, et al., 2004; Shulman, et al., 2006). Before finalising the survey, separate discussions were held with a psycho-geriatrician and psychiatrist regarding their perspectives on cognitive screens from their work in District Health Board settings. They reviewed the list of measures included in the overseas surveys and added some that were not listed.

The final list of 23 screens was rated for frequency of use using a scale with five options (never, seldom, sometimes, often, and routinely), and rated for level of training and experience using a similar 5-point scale. In addition, respondents could add up to three screens not in the list and rate their frequency of use. A further question asked respondents to list the three screens they used most frequently in descending order, (which could include listed and self-generated screens) and to rate their level of confidence in the psychometric properties of the screen used most frequently. Rating options for training and experience were 1.) No formal training or practical experience; 2.) Some practical experience; 3.) Some formal training and practical experience; 4.) Extensive practical experience only; 5.) Extensive training and practical experience.

Further questions explored respondents' views of the importance of test administration factors such as standardisation, proficiency and flexibility, the role and weight of cutoff scores in clinical decision-making, and the factors that determine the use of a particular screen. Three comment boxes were placed through the questionnaire

for respondents to add any comments related to the relevant question, or make comments about screening or the study in general.

Completed questionnaires were submitted electronically through Massey University's Information Technology system. The responses were collated electronically and forwarded to the researcher in an Excel spreadsheet file. The captured data was imported into the SPSS statistical programme for statistical analysis. The statistical methods used involved calculating frequency distributions, means and standard deviations, and ANOVA calculations.

Results

Participant characteristics

The survey resulted in 82 response sets received, with most from geriatric medicine and geriatric psychiatry, followed by psychology and neurology (Table 1). It is uncertain whether the Geriatric Psychiatrists (n=15) were recruited from RANZCP or ANZSGM. No General Psychiatrists responded to the survey. Overall, 853 individuals were invited to participate in the survey, 243 of which received direct email invitations, while 610 (RANZCP members) were invited via an email newsletter.

Of respondents, 36.6% were aged between 46 and 55, 34.1% between 35 and 45, and 13.4% respectively between 56 and 65 and 35 or younger and 2.4% were over 65. Just over half (53.7%) were female. Of respondents, 34% had more than 20 years clinical experience, 28% had 11 to 20 years' experience, and 18% 6-10 years and 0-5 years' experience respectively. This suggests representation from all levels of expertise, but with senior clinicians outnumbering their junior counterparts.

The majority of respondents used cognitive screening measures for queried dementia (99%), age-related cognitive decline (95%), and for differentiating between cognitive impairment and depression (72%). In addition, cognitive screening measures were used in alcohol and drug settings (33%), traumatic brain injury assessments (29%), and with electroconvulsive therapy (16%).

Cognitive Screens

Most respondents (78%) reported routine and regular ("often") use of the Mini-Mental State Exam (MMSE), 74% the Clock Drawing Test (CDT), 43% the Addenbrooke's Cognitive Examination-Revised (ACE-R), 29% the Verbal Fluency Task (FAS), 32% the Three-word Recall (3WR), and 12% the Trail-making Test (TMT). The screens used on a routinely basis were the MMSE, CDT, ACE-R, and 3WR in descending order. Table 2 lists all the screens listed in the questionnaire as well as those added by clinicians. As can be seen, a large number of screens were seldomly or never used. Figure 1 depicts the frequency of use for all measures used sometimes, often, and routinely.

Measuring clinicians' levels of training quantitatively was difficult as there is no standardised training path across occupations when it comes to the use of screening instruments. The highest level of competence – formal training combined with practical experience – accounted for 36% of respondents administering the MMSE, 30% administering the CDT, and 16% and 14% for the FAS and ACE-R respectively. A large number of clinicians reported having extensive practical, supervised experience without formal training. Again, the MMSE had the highest frequency for this rating, (42%), followed by the CDT (28%), the ACE-R, (17.5%) and the FAS (16%). Of

Figure 1. Frequency of use for Screening Measures

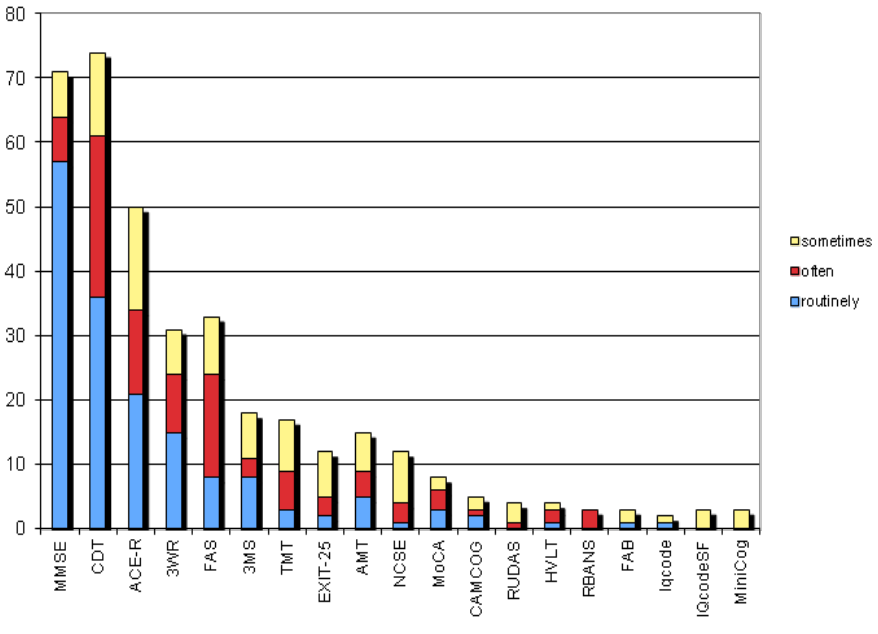

Table 1. Participant numbers and response rates according to professional discipline (N=82)

N	%	Professional Discipline	Response Rate
44	53.7	Geriatric Medicine	32.8% of ANZSGM members
15	18.3	Geriatric Psychiatry	Unknown
14	17	Psychology	23.7% of NZPOPS members
8	9.8	Neurology	16% of NANZ Neurologists
1	1.2	Other (Nursing)	Unknown
0	0	General psychiatry	0% of RANZCP General psychiatrists

Table 2. Screening instruments most frequently used for cognitive impairment

Screen	(*N*)	Routinely % (*n*)	Often % (*n*)	Sometimes % (*n*)	Seldom % (*n*)	Never % (*n*)
Mini-Mental State Exam (MMSE; Folstein, 1975)	82	69.5 (57)	8.5 (7)	8.5 (7)	8.5 (7)	5 (4)
Clock Drawing Test (CDT; Sunderland, 1989)	82	44 (36)	30.5 (25)	16 (13)	2.4 (2)	7.3 (6)
Addenbrooke's Cognitive Examination-Revised (ACE-R; Mioshi, 2006)	79	26.6 (21)	16.5 (13)	20.3 (16)	3.8 (3)	32.9 (26)
Verbal Fluency (FAS; Bechtold, 1962)	76	10.5 (8)	21.1 (16)	11.8 (9)	11.8 (9)	44.7 (34)
Three-Word Recall (3WR; Kuslanski, 2002)	75	20 (15)	12 (9)	9.3 (7)	2.7 (2)	56 (42)
Trail-Making Test (TMT; Reitan, 1958)	74	4.1 (3)	8.1 (6)	10.8 (8)	25.7 (19)	51.4 (38)
Modified Mini-Mental State (3MS; Teng, 1987)	75	10.7 (8)	4 (3)	9.3 (7)	16 (12)	60 (45)
Abbreviated Mental Test (AMT; Hodkinson, 1972)	76	6.6 (7)	5.3 (4)	7.9 (6)	14.5 (11)	65.8 (50)
Neurobehavioral Cognitive Status Exam (NCSE; Kiernan, 1987)	75	1.3 (1)	4 (3)	10.7 (8)	8 (6)	76 (57)
Hopkins Verbal Learning Test (HVLT; Brandt, 1991)	74	1.4 (1)	2.7 (2)	1.4 (1)	1.4 (1)	93.2 (69)
Informant Questionnaire on Cognitive Decline in the Elderly (IQCode; Jorm, 1989)	75	1.3 (1)	0	1.3 (1)	4 (3)	93.3 (70)
Informant Questionnaire on Cognitive Decline in the Elderly-Short Form (IQCode-SF, Jorm, 1994)	73	0	0	4.1 (3)	2.7 (2)	93.2 (68)

MiniCog (Borson, 2000)	74	0	0	4.1 (1.3)	1.4 (1)	94.6 (70)
Time and Change (T&C; Froelich, 1998)	74	0	0	2.7 (2)	1.4 (1)	95.9 (71)
Dementia Questionnaire (DQ; Silverman, 1986)	74	0	0	2.7 (2)	0	97.3 (72)
Cognitive Abilities Screening Inventory (CASI; Teng, 1994)	74	0	0	0	2.7 (2)	97.3 (72)
7-Minute Screen (7MS; Solomon, 1998)	74	0	0	0	2.7 (2)	97.3 (72)
Cognitive Assessment Screening Test (CAST; Drachman, 1996)	72	0	0	0	2.8 (2)	97.2 (70)
Middlesex Elderly Assessment of Mental State (MEAMS; Golding, 1989)	73	0	0	0	1.4 (1)	98.6 (72)
ABCS (Molloy, 2005)	73	0	0	0	1.4 (1)	98.6 (72)
Deterioration Cognitive Observee(DECO; Ritchie, 1996)	71	0	0	0	0	100 (71)
Memory Impairment Screen (MIS; Buschke, 1999)	73	0	0	0	0	100 (73)
Short Portable Mental State Questionnaire (SPMSQ; Pfeiffer, 1975)	73	0	0	0	0	100 (73)
Added:						
The Executive Interview (EXIT-25; Royall, 1992)	15	13.3 (2)	20 (3)	46.7 (7)	20 (3)	0
Montreal Cognitive Assessment (MoCA; Nasreddine, 2005)	11	27.3 (3)	27.3 (3)	36.4 (4)	9.1 (1)	0
CAMCOG(part of CAMDEX; Roth, 1986)	6	33.3 (2)	16.7 (1)	33.3 (2)	0	16.7 (1)
Frontal Assessment Battery (FAB; Dubois, 2000)	5	20 (1)	0	40 (2)	40 (2)	0

Rowland Universal Dementia Assessment Scale (RUDAS; Storey, 2004)	5	0	20 (1)	60 (3)	20 (1)	0		
Repeatable Battery for the Assessment of Neuropsychological Status (RBANS; Randolph, 1998)	3	0	100 (3)	0	0	0		
Rivermead Behavioral Memory Test (RBMT; Wilson, 1985)	2	0	100 (2)	0	0	0		
Alzheimer's Disease Assessment Scale-Cognitive (ADAS-cog; Mohs, 1983)	2	0	50 (1)	50 (1)	0	0		
Digit Span subtest of the WAIS (Wechsler, 1997)	1	0	100 (1)	0	0	0		
Digit Symbol subtest of the WAIS (DS; Wechsler, 1997)	1	100 (1)	0	0	0	0		
Dementia Rating Scale-II (DRS-II; Jurica, 2001)	1	0	0	0	0	100 (1)		
DKEFS Category Switching (Delis, 2001)	1	0	100 (1)	0	0	0		

those screens with which clinicians have had *some* formal training and practical experience, the ACE-R had the highest percentage of 24%, followed by the MMSE (21%), CDT (21%), and FAS (16%).

Regarding the importance of test administration factors such as standardised administration, formal training, supervised practical training, and flexible administration according to patient needs all were rated as "important" and "very important", with the highest mean score obtained for standardised administration (2.89), while flexible administration obtained a mean score of 2.42 (the maximum score possible being 4).

Regarding the role of cutoff scores in clinical decision-making, most respondents (73%) reported that it should inform diagnosis and supplement clinical interviews. Many (41%) reported that screening should often be used as a first step in assessment, indicating the need for more in-depth assessment and a further 6% indicated that step-wise assessment should be routine practice. Two of the 65 responses (3%) indicated that screen cutoff scores alone determined diagnosis.

In determining which factors are most important when clinicians select a specific screen, 8 options were listed. These covered psychometric properties (validity and reliability statistics, research regarding usefulness in your setting, and comprehensive coverage of the cognitive domains), practical issues (time required to use and score, and cost), and familiarity (widespread use, known and trusted, and availability). Respondents were provided with 5 response options "not important", "somewhat important", "important", "very important", and "crucial". Availability was the most highly rated factor (mean score 3.31), followed by validity and reliability statistics (3.17), time to use and score (3.14), research regarding usefulness in your setting (2.92), known and trusted (2.92), widespread use (2.64), comprehensive coverage (2.47), and finally cost (2.24). The median scores for all the items except cost were 3.00, a rating indicating 'very important'. The median score for cost were 2.00, indicating 'important'.

Discussion

The survey indicated that the current sample used the MMSE, CDT, ACE-R, FAS, 3WR, and TMT most frequently. The MMSE consists of six tasks involving immediate and delayed verbal recall, learning ability, short term memory, comprehension of instructions, naming objects, constructing and writing a sentence, and copying a design (Folstein et al., 1975). It covers attention/orientation, memory, language, and visuoconstruction, and takes approximately 5-10 minutes to administer (Folstein et al., 1975). Numerous studies have investigated the psychometric properties of the MMSE, and findings are variable according to the study sample. For example, Tombaugh, McDowell, Kristjansson, and Hubley (1996) reported good sensitivity and specificity, while McDowell, Kristjansson, Hill, and Hebert (1997) reported inadequate to good sensitivity and adequate to excellent specificity depending on the cutoff score used.

The CDT is a simple and reliable measure of visuo-spatial ability, which requires the drawing of a clock face reading the time of 2:45 (Sunderland et al., 1989).

The ACE-R consists of a series of subtests covering 5 cognitive domains: attention/orientation, memory, verbal fluency (a measure of executive function), language, and visuospatial ability (Mioshi et al., 2006). It requires approximately 15 minutes of administration time, has alternate forms, and is accompanied by clear administration and scoring instructions (Mioshi et al., 2006).

The FAS is a time-limited verbal fluency task over three trials, which requires generating a list of words starting with F, A, and S respectively (Bechtold, 1962). The FAS task has been incorporated into a number of screens and assessment batteries including the ACE-R, the MoCA, and the Delis-Kaplan Executive Function System (DKEFS). A recent study (Passos, Giatti, Barreto, Figueiredo, Caramelli, et al., 2011) confirmed the reliability and validity of verbal fluency tests.

The 3WR is another task that is incorporated into a number of screens including the MMSE (Kuslansky, Buschke, Katz, Sliwinski, & Lipton (2002). As a stand-alone test the 3WR had inadequate sensitivity (0.65) and good specificity (0.85), however the associated positive predictive value was poor (0.37) (Kuslansky et al., 2002).

The TMT, originally published in 1958 (Reitan, 1958), is also incorporated in the DKEFS, and measures psychomotor speed and cognitive flexibility. Test-retest reliability was estimated as moderate to high (Matarazzon et al., 1974), and content validity as moderate (Heilbronner et al., 1991).

Consistent with the Reilly (2004) and Shulman (2006) surveys, a large majority of respondents reported frequent use of the MMSE and CDT, despite the varying degree of representation of the various professions.

A finding unique to the current study was that the ACE-R is third most commonly used in New Zealand. The ACE-R has been validated in various settings (Larner, 2007; Reyes, Lloret, & Gersovich, 2009), and has very good to excellent positive predictive values, sensitivity and specificity to both dementia and mild cognitive impairment. The screen includes the MMSE (exact items) and MMSE scores can therefore be formally derived from performance with the ACE-R. In addition, the ACE-R contains a clock-drawing task, a 3-word recall task, an abstract reasoning task (Similarities) and a trail-making task (Mioshi, et al., 2006). The ACE-R therefore contains all the tests rated as most frequently used according to both the Shulman study and current survey. An interesting finding was that a relatively large number of clinicians have had training exposure to the ACE-R, and it may explain why it was used more frequently than others.

What do clinicians look for in a screen for cognitive impairment? As previously described, practical factors such as availability (ranked as most important) and time required to use and score (ranked third most important) were important factors for clinicians when they chose a particular screen. Validity and reliability was considered second most important. Surprisingly, comprehensive coverage of the cognitive domains was rated second *least* important. Clinicians may use the MMSE and CDT most frequently because they meet the requirements of availability and brevity, however most qualitative comments expressed agreement that the MMSE is psychometrically inadequate and biased according to sociodemographic variables. While these factors indirectly suggest why clinicians used the above screens, the survey did not investigate why such a relatively small group of screens were used when there are so many screens currently available. It is likely due to clinicians being familiar with the small number of commonly used screens, while there is little exposure to the less well-known screens.

The survey indicated that cognitive screens were mostly used in assessments of dementia and/or age-related cognitive decline. The current diagnostic shift from detecting severe dementia to milder and/or earlier signs of cognitive impairment (Diniz, Yassuda, Nunes, et al., 2007; Hachinski, 2008), add further weight to the argument that clinicians have come to expect more from cognitive screens, but that the practical issues of day to day work limits a shift to newer and better screens. In other words, there has been a shift in the requirements of screens, but this has not translated into practice. Clinicians continue to use the MMSE despite wide agreement that it is inadequate. This could be due to clinicians seeking continuity, for example when the MMSE is used to monitor change over time, and when comparing scores across patients and research studies where the MMSE was used.

It is recommended that clinicians consider using a more robust screening measure than the MMSE in this patient population. As formal MMSE scores can be derived from the ACE-R, using this screen instead would enable consistency in initial and follow-up assessment, and comparison over time despite a change of routine screen. In cases where time is crucial, the MoCA could be a compromise as it is shorter, very similar to the ACE-R, with clear cognitive domains and satisfactory psychometric properties. It too is freely available, but MMSE scores cannot be derived from the MoCA.

There are a number of limitations to the generalisability of the present study. While the sample at first glance appears to be representative of clinicians belonging to their respective pertinent organisations, it is not representative of those who are not involved with these groups or those who chose not to complete the questionnaire. In hindsight, sampling may have been more representative had recruitment involved mental health services for older adults directly, which would have included Occupational Therapists as well – a group that was not included in the study.

Further, the use of a broad all-inclusive conceptualisation of screening instruments allowed for the inclusion of single cognitive subtests extracted from larger batteries such as the WAIS. However these are not generally considered screening measures as they were not initially designed for screening purposes, do not provide clear dichotomous cutoff scores and often cover single domains of cognitive function only, even though they are often used for screening or quick assessment purposes.

The inclusive approach of the current study (also used in the previous surveys discussed; Reilly et al., 2004; Shulman et al., 2006), allowed for a more comprehensive investigation of clinicians' views on screening, and revealed that respondents often used single subtests, perhaps as part of their own routine testing batteries.

Appendix

note

http://psych-research.massey.ac.nz/strauss/index.htm

http://psych-research.massey.ac.nz/strauss/cognitive-screen_survey.htm

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