Cognitive Screening Instruments in Neuropsychiatry: A Report of the Committee on Research of the American Neuropsychiatric Association

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A 1994 survey by the Research Committee of the American Neuropsychiatric Association revealed that 58% of respondents employed formal assessment of cognitive status; the Mini-Mental State Examination (MMSE) and neuropsychological testing were the commonest techniques. Literature review on common cognitive screening instruments found that the MMSE has widespread popularity, ease of use, and a large body of research demonstrating its sensitivity to common neuropsychiatric disorders. The Committee recommends that clinicians who employ the MMSE 1) use it as a minimum *screening for cognitive dysfunction; 2) employ age- and education-normative corrections; and 3) supplement it with specific measures of spatial functions, delayed memory, and executive abilities. The Modified MMSE and the Neurobehavioral Cognitive Status Examination also show promise as screening tools.*

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In 1994 the Committee on Research of the American Neuropsychiatric Association (ANPA) conducted a survey of ANPA and British Neuropsychiatry Association members regarding use of formal measures of treatment outcome.[1] That survey revealed in part that 58% of respondents employed formal assessment of cognitive status and that the Mini-Mental State Examination and neuropsychological testing were the most common techniques used to evaluate patients. In a follow-up to this survey, the ANPA Committee on Research then conducted a review of the literature on common cognitive screening instruments in order to familiarize ANPA members with data supporting the use of these instruments in neuropsychiatry.

OVERVIEW OF COGNITIVE SCREENING

Need for Cognitive Screening Instruments

The disorders commonly encountered by neuropsychiatrists frequently have cognitive effects that must be

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detected early for accurate diagnosis and effective treatment. Delirium and dementias, for example, represent a substantial portion of the practice of many neuropsychiatrists. Many primary psychiatric disorders, such as major affective disorders and schizophrenia, have significant effects on cognition as well. Focal neurologic disorders such as stroke, seizures, and neoplasms may present with combined emotional and cognitive symptoms.

Cognitive screening can also be used longitudinally to track disease progression or response to treatment. Brief cognitive tests have been used to follow response to cognitive medication trials in dementia,[2] progression in degenerative dementia,[3] and recovery from stroke and head injury.[4]

Use of standard instruments for cognitive screening should be encouraged for several reasons. Cognitive impairment is often overlooked by clinicians who do not routinely employ a formal mental status examination.[5] For example, mild cognitive and behavioral changes after head injury are often underdiagnosed owing to the absence of obvious neurological signs[6] but can have profound effects on long-term patient outcome. Such errors can be minimized if a standard cognitive screening is employed. Use of a brief standardized instrument with adequate norms also serves to minimize interpretation bias on the basis of patient age, education, or other factors.[7]

No cognitive screening device should be used alone to derive a diagnosis, but it may contribute to the identification of deficits and to differential diagnosis if it samples sufficiently from major cognitive domains. The recognition of such conditions as delirium, dementia, and other psychiatric disorders depends on the routine, systematic assessment of cognition. Initial identification of cognitive impairment with a screening instrument can help determine the necessity for other neurodiagnostic techniques, such as detailed neuropsychological testing.

Furthermore, formal cognitive evaluation as a measure of treatment outcome may soon be mandated for managed care and public policy analyses. For example, Annoni et al.[8] used repeated cognitive screening tests to demonstrate that home-based health care for terminally ill patients resulted in improved mental status and satisfaction with care. Clinicians may also use cognitive screens to identify patients requiring increased services: patients with cognitive impairment may underreport medical problems[9] or fail to use medical and support services effectively,[10] resulting in higher long-term health care costs. Detection of cognitive impairment is also important in determining the prognosis of the patient: mental status deficits are associated with negative outcomes ranging from cognitive decline through institutionalization to death.[11,12]

Common Screening Instruments

There are a number of widely used and well-researched cognitive screening tests. Among the most commonly used instruments are the Mini-Mental State Examination[13] (MMSE), Cognitive Capacities Screening Examination (CCSE), and Short Portable Mental Status Questionnaire[14] (SPMSQ).

A number of relatively brief batteries such as the Dementia Rating Scale[15] (DRS) and Alzheimer Disease Assessment Scale[16] (ADAS) can also be considered screening tests, although they are more involved and time-consuming than the screening tests above. These batteries have often been employed in clinical trials in dementia and other disorders.[17]

In addition, there are a number of instruments designed for more specific purposes. For example, the Executive Interview[18] (EXIT) and the Frontal/Subcortical Assessment Battery[19] (FSAB) were designed to measure deficits commonly found in association with frontal lobe and subcortical diseases. These instruments may be of value when used in combination with general cognitive screening instruments in certain populations.

The ideal cognitive screening instrument for use by the practicing clinician would include the following features:

1. Can be administered by clinicians at all levels of training and requires 5 to 15 minutes to administer to most patients.
2. Samples from all major cognitive domains, including orientation, attention/concentration, executive, language, spatial, and memory functions.
3. Research demonstrates adequate test-retest and interrater reliability.
4. Research demonstrates acceptable sensitivity with disorders commonly encountered by neuropsychiatric practitioners.

Nelson et al.[20] reviewed the literature on the reliability and validity of a number of brief screening instruments, including the MMSE, CCSE, SPMSQ, and DRS. They concluded that all of these tests have adequate interrater reliability and that the MMSE and DRS have adequate test-retest reliability. However, all of the tests had substantial false negative rates, which was a particular problem when the patient populations included right hemisphere focal lesions or mild diffuse impairment. Two studies on the MMSE suggested a higher false positive rate in educationally or economically disadvantaged populations.

STRENGTHS AND LIMITATIONS OF THE MMSE

After consideration of these findings by Nelson et al. and the results of the aforementioned ANPA survey, the ANPA Committee on Research decided to focus on the MMSE in this literature review. The MMSE appeared to meet most of the criteria for clinically useful screening tests delineated above, and it has been subjected to more intense research scrutiny with a broader range of diagnoses than any other instrument. Other instruments are more briefly addressed.

Administration

The MMSE requires approximately 12 minutes to administer to most patients. Administration procedures are relatively simple and can be easily mastered by clinicians at all levels of training. However, some of the procedures are not entirely standardized, allowing variability in administration of certain items. For example, the clinician is permitted to test concentration by asking the patient either to perform serial subtraction or to spell "world" backwards. Clinicians are advised to use the same procedures with each patient (and on repeated testings to allow comparison of results) or to adopt the more standardized Modified Mini-Mental State Examination discussed later in this report.

Content

The MMSE contains items designed to assess a reasonably wide range of functions, including orientation to time and place, attention/concentration, language functions (following a three-step command, repeating a difficult phrase, naming high-frequency items, reading and following a written command, and writing a sentence), construction, verbal learning, and short-delay recall.

The MMSE has a number of limitations in content:

1. Memory testing is limited to brief delayed recall of three words. Cullum et al.[21] demonstrated substantial variability in the recall of three words in healthy elderly patients and found only low to moderate correlations between this task and scores on neuropsychological tests of memory. The MMSE does not assess long-delay recall, which can result in false negatives in the evaluation of relatively mild memory disorder. There is also no cued or recognition memory testing; such testing may be useful in making recommendations for rehabilitation and staff or family interventions.
2. The MMSE does not directly assess executive or "frontal lobe" functions and may therefore be insensitive to disorders such as Pick's disease, in which other cognitive domains are frequently intact.
3. Assessments of most abilities are limited to a single item, and there is no graded scoring. For example, the relatively complex intersecting pentagon drawing is scored either correct or incorrect.
4. Administration is not well standardized, resulting in variability across examiners. For example, the two measures of attention (serial sevens and spelling "world" backwards) are often used interchangeably, but the latter is a significantly easier test for most subjects.[22]
5. The MMSE presents relatively modest intellectual challenges and is insensitive to mild cognitive changes.[23]

Reliability

The MMSE has been shown to have adequate test-retest (0.89) and interrater (0.82) reliability.[13]

Validity

Dementia: The MMSE successfully discriminates patients with dementia of the Alzheimer's type from normal subjects with 87% sensitivity and 82% specificity.[13] MMSE scores correlate with EEG abnormalities: demented patients with equivocal impairment (42%) and most patients with mild to moderate impairment (65%) on the MMSE have abnormal EEGs.[24]

The MMSE appears to be sensitive to longitudinal change in dementia as well.[25] Ashford et al.[26] demonstrated a systematic progression of the development of symptoms in Alzheimer's disease through item analysis of the MMSE. Temporal orientation was lost before spatial and object orientation, and recollection of words was lost before ability to repeat them. Low "normal" range scores of 24 or 25 have been shown to predict later development of dementia in a sample of patients with mean age of 81 who were followed over a 6-year period.[27] In another longitudinal study of outpatients with dementia, Uhlmann et al.[28] showed that MMSE at entry was significantly correlated with change in living arrangement and mortality during a subsequent year of follow-up.

The MMSE appears to be insensitive to mild levels of dementia.[16,20,29,30] For example, Nadler et al.[23] reported a 40% false negative rate in patients displaying mild impairment on formal neuropsychological testing. The MMSE does not provide the detailed information necessary to distinguish among different types of dementia (a limitation shared by most screening measures).

Delirium: The MMSE is capable of detecting patients with delirium or combined delirium and dementia.[31] Hier et al.[32] tested three measures of confusion in a

medical intensive care unit. The MMSE, Clinical Assessment of Confusion–A, and Visual Analog Scale of Confusion were administered to 53 critically ill patients for 3 to 8 days. Psychometric analyses demonstrated the MMSE was a reliable, valid instrument in this population, and high correlations were found between the MMSE and the other instruments.

The MMSE may also be used to track recovery from delirium.[33] In fact, the MMSE has been found to correlate with longitudinal changes in EEG in a prospective study of nursing home patients with delirium.[34] Fields et al.[35] found that elderly patients who recovered from cognitive impairment (presumably with delirium and reversible dementias) had higher scores initially on the MMSE when tested prior to recovery.

Focal Lesions: The MMSE was originally designed to evaluate dementia, not focal neurologic disorders, but neuropsychiatrists require an instrument that is reasonably sensitive to these disorders as well. Previous vascular events, presence of plaques in the carotid arteries, and presence of peripheral arterial atherosclerotic disease are associated with worse MMSE performance independent of the effects of age and education.[36]

However, the MMSE is insensitive to "silent" stroke (stroke without obvious sensorimotor change).[37] The MMSE also appears to be limited in detecting mental status changes in multiple sclerosis that are detectable by more formal neuropsychological assessment.[38,39] Beatty and Goodkin[40] studied 85 patients with clinically definite multiple sclerosis who also received an extensive battery of neuropsychological tests. Although scores on the MMSE were negatively correlated with a number of neuropsychological tests, the MMSE was not sufficiently sensitive to identify dementia in these patients.

Perhaps consequent to the content weaknesses noted previously, the MMSE has been shown to have poor sensitivity to visuospatial deficits due to right hemisphere stroke[4] and other right brain lesions.[41,42] Similarly, because of the absence of long-delay recall testing, the MMSE can fail to detect amnesia. For example, Benedict and Brandt[43] demonstrated that patients with severe amnestic deficits on neuropsychological testing were nonetheless able to perform above the standard cutoff on the MMSE, and many even passed the three-item recall. Supplementary tests of spatial abilities and memory over a longer retention interval are essential in these patient groups.

Data are mixed regarding the sensitivity of the MMSE to executive, self-regulatory, or "frontal lobe" deficits. Although the MMSE was not designed to measure behavior in these domains directly, several studies have demonstrated correlations between MMSE scores and tests of executive functions in normal elderly subjects.[44] However, other studies have shown that the MMSE is insensitive to executive impairment demonstrated on such alternative measures as the EXIT in patients with dementing illnesses.[45] Rothlind and Brandt[19] found that patients with dementia of Huntington's disease and Parkinson's disease performed as well as normal control subjects on the MMSE but significantly worse on the FSAB. Discriminant function analyses yielded significantly higher rates of accurate classification with FSAB and MMSE combined than with MMSE alone. The authors recommended the FSAB as an adjunct to the MMSE for brief assessments of patients with suspected frontal or subcortical pathology.

The language-dependent content of the MMSE makes it sensitive to aphasia, and aphasic patients frequently fail both the "language" and "nonlanguage" items of the MMSE.[46,47]

Psychiatric Disorders: O'Boyle et al.[48] demonstrated that "pseudodemented" depressed subjects who recovered with treatment improved significantly on the MMSE. Both initial poor performance on the MMSE and deterioration in scores are associated with increased risk of hospitalization, more hospital days, and longer average length of stay for psychiatric disorders.[49]

The MMSE may not detect subtle cognitive deficits produced by psychiatric conditions that cause no other demonstrable neurologic dysfunction. The MMSE was not able to detect deficits in many psychiatric patients who demonstrated significant abnormalities on a neuropsychological battery.[50] Lamarre and Patten[51] also found that the MMSE had low sensitivity in psychiatric disorders, with the standard cutoff yielding a sensitivity of only 38%. MMSE scores are not related to response to neuroleptics in patients with schizophrenia.[52]

Norms

Most studies have shown that scores on the MMSE vary with age and education, independent of medical status.[53] Community-dwelling elderly individuals with lower education are more likely to score below the standard cutoff of 24, in the absence of demonstrable neurologic disease.[54,55] For example, Worrall[56] found that the most accurate lower limits of normal for MMSE scores (and their attendant sensitivities and specificities) were 21 for middle school (0.82/0.94), 23 for high school (0.79/0.97), and 24 for college/graduate school (0.83/1.00) attainment. Degree of literacy is also strongly related to MMSE performance, particularly on language items.[57]

Crum et al.[58] conducted a study to derive age- and

education-corrected norms for the MMSE, based on data from the National Institute of Mental Health Epidemiologic Catchment Area Program surveys conducted between 1980 and 1984. MMSE scores were found to be related to both age and educational level. In reviewing these data, Cummings[7] noted that mean MMSE scores of individuals with 0 to 4 years of education were 19 to 25 (depending on age), whereas mean scores of those with college education were 27 to 29. Based on the lower quartile, he suggested cutoffs of 19 for those with 0 to 4 years of education, 23 for those with 5 to 8 years, 27 for those with 9 to 12 years, and 29 for those with college education.

Bleecker et al.[59] have also provided age-corrected norms on a sample of 194 healthy men and women carefully screened for systemic, neurologic, or psychiatric illness that might affect cognition. The resultant sample appeared to represent "supernormals," in that their mean years of education ranged from 13 to 16 (depending on age group) and they were free of medical problems at an advanced age. Such characteristics are not typical of the population at large. Determining what is "normal" in an aging population is a difficult issue common to all such normative studies.

Ethnicity and native language also affect MMSE scores. A Spanish version of the MMSE[60] has been shown to be more accurate in detecting severe cognitive impairment in native Spanish speakers. Escobar et al.[61] conducted an item analysis of the MMSE in a sample with mixed ethnicity (Hispanic and non-Hispanic). They found that ethnicity and language had the greatest effects on the orientation items (season, state, county), the attention items (calculation and backward spelling), and the repetition item—probably because the idiomatic expression was translated literally. When these items were dropped and a new cutoff of 9 errors was used, the prevalence of cognitive impairment in Hispanics and non-Hispanics was similar. Chinese- and Finnish-language versions of the MMSE have also been developed,[62,63] and interesting cultural/ethnic differences have been observed (for example, elderly Chinese subjects had better recall but poorer copying than elderly Finnish subjects) that warrant further investigation.

The setting in which a test is to be used is an important factor in determining appropriate cutoff scores because base rates of a disorder affect the sensitivity and specificity of a test. Norms appropriate to a clinic where most patients are later found to have dementia may yield high false positive rates when used in community screening. Thus, in one study,[64] only one-third of one community sample scoring below the "standard" cutoff of 24 were found to be demented on further evaluation; the remainder had psychiatric disorders or received no diagnosis. Similarly, use of Bleecker and colleagues'[59] cutoffs in a community sample would likely identify as impaired many patients with low education but without neuropsychiatric disorders.

PROMISING NEWER INSTRUMENTS AND MODIFICATIONS OF THE MMSE

Modified Mini-Mental State Examination (3MSE)

The 3MSE[65] addresses some of the limitations of the MMSE by making administration procedures more explicit and expanding the number and difficulty level of items to "test the limits" of patient ability. The range of scores for the 3MSE is 0 to 100, and a standard cutoff of 79 recommended. (This scoring compares with a range of 0 to 30 and a cutoff of 24 for the MMSE.) The standard MMSE items are embedded in the 3MSE, allowing the user to extract MMSE scores if desired for clinical or research purposes. The 3MSE takes about 30 minutes to administer, however. There have not been adequate normative studies to allow the clinician to correct for the effects of age and education.

Research on the 3MSE is limited, but studies to date are encouraging. Ronnberg and Ericsson[66] used the 3MSE successfully to identify demented persons in both community and institutionalized samples for an epidemiological study. Grace et al.[4] directly compared the MMSE and 3MSE in a group of patients in a stroke rehabilitation program who were administered both tests on entry into treatment and at discharge. They found that the 3MSE had higher correlations with neuropsychological test results than the MMSE and was a better predictor of functional outcome of rehabilitation. However, neither instrument was sensitive to many deficits in patients with right hemisphere stroke. Lamarre and Patten[51] found that the 3MSE was somewhat more sensitive to cognitive deficit in psychiatric populations, a traditional weakness of the MMSE.

Neurobehavioral Cognitive Status Examination (NCSE)

The NCSE evaluates cognitive functioning within five major ability areas: language, constructions, memory, calculations, and reasoning. The examination separately assesses level of consciousness, orientation, and attention. The NCSE requires about 45 minutes to administer, considerably more time than the MMSE. The original article introducing the NCSE[67] provided standardization data for 119 healthy adults (ages 20–92 years) and for 30 patients receiving neurosurgical care for brain lesions (ages 25–88 years).

The NCSE is sensitive to subtle postoperative cogni-

tive changes in neurosurgical patients.[68] Schwamm et al.[41] also showed that the NCSE is more sensitive in the detection of cognitive dysfunction than the MMSE or CCSE in neurosurgical patients. They compared the three examinations in 30 patients with documented brain lesions. The false negative rate was 53% for the CCSE, 43% for the MMSE, and only 7% for the NCSE. They argued that the greater sensitivity of the NCSE was derived from the use of independent tests to assess skills within five major areas of cognitive functioning and the use of graded tasks within each of these cognitive domains. Mysiw et al.[69] demonstrated that the NCSE was a more sensitive indicator of functional impairment in stroke rehabilitation patients than the MMSE (especially in subsections of orientation and memory) and that it predicted functional status change as a result of inpatient stroke rehabilitation.

Hill et al.[70] tested a total of 866 psychiatric patients (ages 15–92 years) with the NCSE shortly after hospital admission. Data revealed consistently poorer performance for psychiatric patients relative to the original normative sample. Pearson product-moment correlations between age and each NCSE subtest similarly yielded significant negative correlations, particularly on tests predicted to be differentially sensitive to aging. They concluded that the NCSE provides a moderately valid screening instrument for cognitive impairment in psychiatric patients.

Englehart et al.[71] examined the psychometric properties of the NCSE in another large, heterogeneous psychiatric sample. They confirmed the sensitivity of the instrument to the presence of cognitive impairment, but they questioned its specificity. They found that the instrument was not very successful at differentiating subjects with evidence of "organicity" (based primarily on neurologic examination, sometimes supplemented by neuroimaging) from those with major psychiatric disorder only. Of course, the NCSE may have correctly identified cognitive impairment in these psychiatric patients who were referred clinically for neuropsychological testing. No independent criterion measure for cognitive impairment was reported (such as agreement with results of neuropsychological tests).

In a similar study that used psychiatrist judgment as the criterion, Ashford[72] examined the ability of the NCSE to detect global cognitive impairment among geriatric inpatients in comparison to the MMSE. Comparisons of the MMSE and NCSE revealed, respectively, the following: sensitivity, 83% versus 100%; specificity, 78% versus 11%; positive predictive value, 83% versus 43%; and negative predictive value, 78% versus 100%. Thus, the NCSE was found to be more sensitive than the

TABLE 1. Mini-Mental State Examination score by age and educational level. Data from the Epidemiologic Catchment Area household surveys between 1980 and 1984. The data are weighted based on the 1980 U.S. population census by age, sex, and race

Educational Level	Age (years)														
	18–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	≥ 85	Total
0–4 years															
n	17	23	41	33	36	28	34	49	88	126	139	112	105	61	892
Mean	22	25	25	23	23	23	23	22	23	22	22	21	20	19	22
SD	2.9	2.0	2.4	2.5	2.6	3.7	2.6	2.7	1.9	1.9	1.7	2.0	2.2	2.9	2.3
5–8 years															
n	94	83	74	101	100	121	154	208	310	633	533	437	241	134	3,223
Mean	27	27	26	26	27	26	27	26	26	26	26	25	25	23	26
SD	2.7	2.5	1.8	2.8	1.8	2.5	2.4	2.9	2.3	1.7	1.8	2.1	1.9	3.3	2.2
9–12 years or high school diploma															
n	1,326	958	822	668	489	423	462	525	626	814	550	315	163	99	8,240
Mean	29	29	29	28	28	28	28	28	28	28	27	27	25	26	28
SD	2.2	1.3	1.3	1.8	1.9	2.4	2.2	2.2	1.7	1.4	1.6	1.5	2.3	2.0	1.9
College experience or higher degree															
n	783	1,012	989	641	354	259	220	231	270	358	255	181	96	52	5,701
Mean	29	29	29	29	29	29	29	29	29	29	28	28	27	27	29
SD	1.3	0.9	1.0	1.0	1.7	1.6	1.9	1.5	1.3	1.0	1.6	1.6	0.9	1.3	1.3
Total															
n	2,220	2,076	1,926	1,443	979	831	870	1,013	1,294	1,931	1,477	1,045	605	346	18,056
Mean	29	29	29	29	28	28	28	28	28	27	27	26	25	24	28
SD	2.0	1.3	1.3	1.8	2.0	2.5	2.4	2.5	2.0	1.6	1.8	2.1	2.2	2.9	2.0

Note: Adapted, by permission, from R. M. Crum et al., "Population-Based Norms for the Mini-Mental State Examination by Age and Educational Level" (JAMA 1993; 269:2386–2391); copyright © 1993 American Medical Association.

MMSE in detecting cognitive impairment, but its specificity and positive predictive values were lower.

RECOMMENDATIONS FOR SCREENING PROCEDURES

The ANPA Committee on Research recommends that clinicians use a standard screening instrument as part of the initial assessment of cognitive functions in order to minimize false negative errors in initial evaluations, allow for treatment outcome research in neuropsychiatric disorders, and facilitate collaboration across sites.

The optimum screening instrument for neuropsychiatric mental status has yet to be developed. In the interim, the many ANPA members who choose the MMSE should be aware of its strengths and limitations.

As the foregoing review illustrates, the MMSE has a number of compelling advantages: widespread popularity, ease of use, and a large body of research demonstrating its sensitivity to common neuropsychiatric disorders. We recommend that clinicians who employ this popular instrument use it as a minimum screening for cognitive dysfunction. Clinicians should employ age- and education-normative corrections in interpretation of MMSE scores. For the convenience of the reader, norms from the Epidemiologic Catchment Area study[58] are presented in Table 1.

Many of the limitations of the MMSE have been addressed by the 3MSE, and the Committee on Research endorses its use whenever possible. Although the 3MSE has not yet received the same research scrutiny as the MMSE, standard MMSE scores can be abstracted from the 3MSE. Thus, little is lost by its routine use (except increased administration time), whereas the gains include increased standardization of administration procedures and detailed testing of specific abilities that can be useful in differential diagnosis.

The Committee on Research also recommends that the MMSE or 3MSE be supplemented by specific measures of spatial functions, delayed memory, and executive abilities not adequately sampled by the MMSE. Supplementary tests are particularly important when the clinician suspects right hemisphere dysfunction (as in lateralized stroke), amnestic disorder without dementia, or frontal lobe involvement (for example, personality change in a demented patient suggesting a frontal lobe degeneration). Of course, in most patients the differential diagnosis is initially broad, and the wise clinician will routinely sample widely across cognitive domains.

Clinicians working in settings in which they see a high proportion of acute neurological or neurosurgical patients should consider using the NCSE. The NCSE is not as well researched as some other measures such as the MMSE or CCSE, but it appears to have certain advantages in patients with focal lesions. Its specificity in mixed psychiatric and neurologic populations remains to be clearly established.

Finally, it is important to emphasize that cognitive assessment is only one aspect of the thorough evaluation of the patient.[73] Medical history, family report, emotional functioning, demeanor and social behavior, and functioning in activities of daily living must all be included in the neuropsychiatric examination. Laboratory tests and neuroimaging will confirm or fail to support diagnostic hypotheses generated by the initial neuropsychiatric examination.

References

1. Coffey CE, Cummings JL, Duffy JD, et al: Assessment of treatment outcomes in neuropsychiatry: a report from the Committee on Research of the American Neuropsychiatric Association. J Neuropsychiatry Clin Neurosci 1995; 7:287–289
2. Balestreri R, Fontana L, Astengo F: A double-blind placebo controlled evaluation of the safety and efficacy of vinpocetine in the treatment of patients with chronic vascular senile cerebral dysfunction. J Am Geriatr Soc 1987; 35:425–430
3. Fratiglioni L, Jorm AF, Grut M, et al: Multicenter study of predictors of disease course in Alzheimer disease (the "predictors study"), II: neurological, psychiatric, and demographic influences on baseline measures of disease severity. Alzheimer Dis Assoc Disord 1993; 7:22–32
4. Grace J, Nadler JD, White DA, et al: Folstein vs Modified Mini-Mental State Examination in geriatric stroke. Arch Neurol 1995; 52:477–484
5. Anderson J, Dayson D, Wills W, et al: Cognitive function: survey of elderly persons living at home in rural Newfoundland. Can Fam Physician 1993
6. Askenasy JJ, Rahmani L: Neuropsycho-social rehabilitation of head injury. Am J Phys Med 1987; 66:315–327
7. Cummings JL: Mini-Mental State Examination: norms, normals, and numbers (editorial; comment). JAMA 1993; 269:2420–2421
8. Annoni JM, Beer S, Kesselring J: A randomized trial of the cost effectiveness of VA hospital-based home care for the terminally ill. Health Serv Res 1992; 26:801–817
9. Aronson MK, Post DC, Guastadisegni P: Pain complaints and cognitive status among elderly institution residents. J Am Geriatr Soc 1993; 41:517–522
10. Fogel B: The significance of frontal system disorders for medical practice and health policy. J Neuropsychiatry Clin Neurosci 1994; 6:343–347
11. Owsley C, Ball K, Sloane ME, et al: The accuracy of early diagnosis and predictors of death in Alzheimer's disease and vascular dementia: a follow-up study. Acta Psychiatr Scand 1991; 84:277–282
12. Eagles JM, Beattie JA, Restall DB, et al: Relation between cognitive impairment and early death in the elderly. BMJ 1990; 300:239–240
13. Folstein MF, Folstein SE, McHugh PR: "Mini-Mental State": a practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975; 12:189–198
14. Pfeiffer E: A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. J Am Geriatr Soc 1975; 23:433–441

15. Mattis S: Dementia Rating Scale Professional Manual. Odessa, FL, Psychological Assessment Resources, 1973
16. Devenny DA, Hill AL, Patxot O, et al: Alzheimer Disease Assessment Scale: useful for both early detection and staging of dementia of the Alzheimer type. Alzheimer Dis Assoc Disord 1992; 6:89–102
17. Mathers DC, Ghodse AH: A controlled trial of tacrine in Alzheimer's disease: the Tacrine Study Group. JAMA 1992; 268:2523–2529
18. Royall DR, Mahurin RK, Gray KF: Bedside assessment of executive cognitive impairment: the Executive Interview. J Am Geriatr Soc 1992; 40:1221–1226
19. Rothlind JC, Brandt J: A brief assessment of frontal and subcortical functions in dementia. J Neuropsychiatry Clin Neurosci 1993; 5:73–77
20. Nelson A, Fogel BS, Faust D: Bedside cognitive screening instruments: a critical assessment. J Nerv Ment Dis 1986; 174:73–83
21. Cullum MC, Thompson LL, Smernoff EN: Three-word recall as a measure of memory. J Clin Exp Neuropsychol 1993; 15:321–329
22. Ganguli M, Ratcliff G, Huff FJ, et al: Serial sevens versus world backwards: a comparison of the two measures of attention from the MMSE. J Geriatr Psychiatry Neurol 1990; 3:203–207
23. Nadler JD, Richardson ED, Malloy PF: Detection of impairment with the Mini-Mental State Examination. Neuropsychiatry, Neuropsychology, and Behavioral Neurology 1994; 7:109–113
24. Petit D, Montplaisir J, Lorrain D, et al: Prevalence and significance of electroencephalographic abnormalities in patients with suspected organic mental syndromes. J Am Geriatr Soc 1993; 41:605–611
25. Bruera E: Predictors of decline in Alzheimer's disease. Cortex 1991; 27:9–17
26. Ashford JW, Kolm P, Colliver JA, et al: Alzheimer patient evaluation and the Mini-Mental State: item characteristic curve analysis. J Gerontol 1989; 44:139–146
27. Braekhus A, Laake K, Engedal K: A low, "normal" score on the Mini-Mental State Examination predicts development of dementia after three years. J Am Geriatr Soc 1995; 43:656–661
28. Uhlmann RF, Larson EB, Buchner DM: Correlations of Mini-Mental State and modified Dementia Rating Scale to measures of transitional health status in dementia. J Gerontol 1987; 42:33–36
29. Swirsky ST, Field HL, Mitchell DR, et al: Longitudinal diagnosis of memory disorders (published erratum appears in Age Ageing 1993; 22:232). Age Ageing 1992; 21:393–397
30. Sabe L, Jason L, Juejati M, et al: Sensitivity and specificity of the Mini-Mental State Exam in the diagnosis of dementia. Behavioral Neurology 1993; 6:207–210
31. O'Neill D, O'Shea B, Walsh JB, et al: Screening for dementia and delirium using an adapted Folstein Mini-Mental State Examination. Ir Med J 1989; 82:24–25
32. Hier DB, Jao CS, Brint SU: Measuring clinical confusion in critically ill patients. J Neurosci Nurs 1994; 26:146–150
33. Koponen HJ, Riekkinen PJ: A prospective study of delirium in elderly patients admitted to a psychiatric hospital. Psychol Med 1993; 23:103–109
34. Levkoff S, Liptzin B, Cleary P, et al: Bedside clinical and electrophysiological assessment: assessment of change in vulnerable patients. Int Psychogeriatr 1991; 3:289–300
35. Fields SD, Mac KC, Charlson ME, et al: Reversibility of cognitive impairment in medical inpatients. Arch Intern Med 1986; 146:1593–1596
36. Ames D, Tuckwell V: Cardiovascular disease and distribution of cognitive function in elderly people: the Rotterdam Study. BMJ 1994; 308:1604–1608
37. Waldemar G, Walovitch RC, Andersen AR, et al: Silent infarction in acute stroke patients: prevalence, localization, risk factors, and clinical significance: the Copenhagen Stroke Study. Stroke 1994; 25:97–104
38. Kaplan KH, Strang JP, Ahmed I: Correlation of neuropsychological and MRI findings in chronic/progressive multiple sclerosis. Neurology 1988; 38:1826–1829
39. Pearce C: The sensitivity of the Mini-Mental State Exam in the white matter dementia of multiple sclerosis. J Clin Psychol 1992; 48:779–786
40. Beatty WW, Goodkin DE: Screening for cognitive impairment in multiple sclerosis: an evaluation of the Mini-Mental State Examination. Arch Neurol 1990; 47:297–301
41. Schwamm LH, Van DC, Kiernan RJ, et al: The Neurobehavioral Cognitive Status Examination: comparison with the Cognitive Capacity Screening Examination and the Mini-Mental State Examination in a neurosurgical population. Ann Intern Med 1987; 107:486–491
42. Dick JPR, Guiloff RJ, Stewart A, et al: Mini-Mental State Examination in neurologic patients. J Neurol Neurosurg Psychiatry 1984; 47:496–499
43. Benedict RHB, Brandt J: Limitations of the Mini-Mental State Examination for the detection of amnesia. J Geriatr Psychiatry Neurol 1992; 5:233–237
44. Feher EP, Mahurin RK, Doody RS, et al: Sensitivity of the Mini-Mental State Examination to frontal lobe dysfunction in normal aging. J Clin Psychol 1992; 48:68–71
45. Royall DR, Mahurin RK, Cornell J: Bedside assessment of frontal degeneration: distinguishing Alzheimer's disease from non-Alzheimer's cortical dementia. Exp Aging Res 1994; 20:95–103
46. Cummings JL, Benson F, Hill MA, et al: Aphasia in dementia of the Alzheimer type. Neurol 1985; 35:394–397
47. Engel P, Cummings JL, Villanueva-Meyer J, et al: Single photon emission computed tomography in dementia: relationship of perfusion to cognitive deficits. J Geriatr Psychiatry Neurol 1993; 6:144–151
48. O'Boyle M, Amadeo M, Self D: Cognitive complaints in elderly depressed and pseudodemented patients. Psychol Aging 1990; 5:467–468
49. Binder EF, Robins LN: Cognitive impairment and length of hospital stay in older persons. J Am Geriatr Soc 1990; 38:759–766
50. Faustman WO, Moses JJ, Csernansky JG: Limitations of the Mini-Mental State Examination in predicting neuropsychological functioning in a psychiatric sample. Acta Psychiatr Scand 1990; 81:126–131
51. Lamarre CJ, Patten SB: Evaluation of the Modified Mini-Mental State Examination in a general psychiatric population. Can J Psychiatry 1991; 36:507–511
52. Bartko G, Frecska E, Zador G, et al: Neurological features, cognitive impairment and neuroleptic response in schizophrenic patients. Schizophr Res 1989; 2:311–313
53. Koh K, Ray R, Lee J, et al: The relationship between health and cognitive functioning in a sample of elderly people in the community. Age Ageing 1994; 23:204–212
54. O'Connor DW, Pollitt PA, Treasure FP, et al: The influence of education, social class and sex on Mini-Mental State scores. Psychol Med 1989; 19:771–776
55. Meneilly GS, Cheung E, Tessier D, et al: Sensitivity and specificity for dementia of population-based criteria for cognitive impairment: the MoVIES project. J Gerontol 1993; 48:61
56. Worrall G: Effect of education on the Mini-Mental State Examination as a screening test for dementia. J Am Geriatr Soc 1991; 39:876–880
57. Weiss BD, Reed R, Kligman EW, et al: Literacy and performance on the Mini-Mental State Examination. J Am Geriatr Soc 1995; 43:807–810
58. Crum RM, Anthony JC, Bassett SS, et al: Population-based norms for the Mini-Mental State Examination by age and educational level. JAMA 1993; 269:2386–2391
59. Bleecker ML, Bolla WK, Kawas C, et al: Age-specific norms for the Mini-Mental State Exam. Neurology 1988; 38:1565–1568
60. Burnham MA, Karno M, Hough RL, et al: The Spanish Diagnostic Interview Schedule: reliability and comparison with clinical diagnosis. Arch Gen Psychiatry 1983; 40:1189–1196
61. Escobar JI, Burnham A, Karno M, et al: Use of the Mini-Mental State

Examination (MMSE) in a community population of mixed ethnicity. J Nerv Ment Dis 1986; 174:607–614
62. Katzman R, Zhang MY, Ouang YQ, et al: A Chinese version of the Mini-Mental State Examination: impact of illiteracy in a Shanghai dementia survey. J Clin Epidemiol 1988; 41:971–978
63. Salmon DP, Riekkinen PJ, Katzman R, et al: Cross-cultural studies of dementia: a comparison of Mini-Mental State Examination performance in Finland and China. Arch Neurol 1989; 46:769–772
64. Folstein M, Anthony JC, Parhad I, et al: The meaning of cognitive impairment in the elderly. J Am Geriatr Soc 1985; 33:228–235
65. Teng EL, Chui HC: The Modified Mini-Mental State (3MS) Examination. J Clin Psychiatry 1987; 48:314–318
66. Ronnberg L, Ericsson K: Canadian study of health and aging: study methods and prevalence of dementia. Can Med Assoc J 1994; 150:899–913
67. Kiernan RJ, Mueller J, Langston JW, et al: The Neurobehavioral Cognitive Status Examination: a brief but quantitative approach to cognitive assessment. Ann Intern Med 1987; 107:481–485
68. Cammermeyer M, Evans JE: A brief neurobehavioral exam useful for early detection of postoperative complications in neurosurgical patients. J Neurosci Nurs 1988; 20:314–323
69. Mysiw WJ, Beegan JG, Gatens PF: Prospective cognitive assessment of stroke patients before inpatient rehabilitation: the relationship of the Neurobehavioral Cognitive Status Examination to functional improvement. Am J Phys Med Rehabil 1989; 68:168–171
70. Hill LR, Klauber MR, Salmon DP, et al: The Neurobehavioral Cognitive Status Examination: psychometric properties in use with psychiatric inpatients. J Clin Psychol 1993; 49:80–89
71. Englehart C, Eisenstein N, Meininger J: Psychometric properties of the Neurobehavioral Cognitive Status Exam. The Clinical Neuropsychologist 1994; 8:405–415
72. Ashford JW, Kumar V, Barringer M, et al: Usefulness of the Neurobehavioral Cognitive Status Examination in the hospitalized elderly. Int Psychogeriatr 1992; 4:93–102
73. Warshaw G: Are mental status questionnaires of clinical value in everyday office practice? An affirmative view. J Fam Pract 1990; 30:194–197