Standardized Mini-Mental State Examination

Use and interpretation

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ABSTRACT

OBJECTIVE To review administration of the Standardized Mini-Mental State Examination (SMMSE) for dementia and depression and to evaluate how well it interprets older people's cognitive function.

QUALITY OF EVIDENCE Literature from January 1990 to December 1999 was searched via MEDLINE using the MeSH headings Alzheimer Disease, Vascular Dementia, Lewy Bodies, and Depression. Several studies have described the reliability and validity of the SMMSE.

MAIN MESSAGE The SMMSE, a standardized approach to scoring and interpreting older people's cognitive function, provides a global score of cognitive ability that correlates with daily function. Careful interpretation of results of the SMMSE, together with history and physical assessment, can assist in differential diagnosis of cognitive impairment resulting from Alzheimer's disease, vascular dementia, dementia with Lewy bodies, or depression. Repeated measurements can be used to assess change over time and response to treatment.

CONCLUSION The SMMSE is a valuable tool for family doctors who are often the first medical professionals to identify changes in patients' cognitive function. The SMMSE requires little time to complete and is a key component of a comprehensive dementia workup. Determining whether a patient has dementia is important because there are now effective medications that are most beneficial if started early.

RÉSUMÉ

OBJECTIF Passer en revue l'administration du mini-examen de l'état mental normalisé (SMMSE) dans les cas de démence et de dépression, et évaluer leur efficacité dans l'interprétation de la fonction cognitive chez les personnes âgées.

QUALITÉ DES DONNÉES Une recension dans les ouvrages scientifiques à l'aide de MEDLINE a été effectuée entre janvier 1990 et décembre 1999. Les rubriques MeSH utilisées en anglais étaient «maladie d'Alzheimer, démence vasculaire, démence avec corps de Lewy ou dépression». Quelques études ont décrit la fiabilité et la validité du SMMSE.

PRINCIPAL MESSAGE Le SMMSE, une approche normalisée pour coter et interpréter la fonction cognitive chez les personnes âgées, procure une cote globale de l'habileté cognitive qui est associée aux activités de la vie courante. Une interprétation avisée des résultats du SMMSE, accompagnée d'une anamnèse et d'un examen physique, peut aider dans le diagnostic différentiel de la déficience cognitive causée par la maladie d'Alzheimer, la démence vasculaire, la démence avec corps de Lewy ou la dépression. La répétition de la mesure peut servir à évaluer les changements avec le temps et la réaction au traitement.

CONCLUSION Le SMMSE est un outil utile aux médecins de famille, qui sont souvent les premiers professionnels médicaux à identifier des changements dans la fonction cognitive chez les patients. Le SSMSE prend peu de temps à administrer et il représente une composante clé d'une évaluation complète de la démence. Il est important de déterminer la présence de la démence chez les patients parce qu'il existe maintenant des pharmacothérapies efficaces qui sont plus bénéfiques si elles sont administrées aux premiers stades de l'affection.

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The Mini-Mental State Examination (MMSE) is a valid and reliable instrument widely used to screen for cognitive impairment in older adults.[1] The reliability of the original instrument was improved by adding explicit guidelines for administration and scoring (the Standardized MMSE [SMMSE]). The SMMSE is used for comprehensive assessments of older adults. It provides a global score of cognitive ability that correlates with function in activities of daily living.

The SMMSE measures various domains of cognitive function including orientation to time and place; registration; concentration; short-term recall; naming familiar items; repeating a common expression; and the ability to read and follow written instructions, write a sentence, construct a diagram, and follow a three-step verbal command. The SMMSE takes approximately 10 minutes to administer, provides a baseline score of cognitive function, and pinpoints specific deficits that can aid in forming a diagnosis.

Quality of evidence

Current literature from January 1990 to December 1999 was searched via MEDLINE using the MeSH headings Alzheimer Disease, Vascular Dementia, Lewy Bodies, and Depression. Articles were selected based on clinical relevance; preference was given to current articles. Interpretation of results of the SMMSE was based on clinical findings and trends observed by the authors in a large outpatient population at a dementia clinic. Many studies describe the SMMSE's reliability and validity.

Inter-rater and intrarater reliability of the SMMSE was compared with that of the traditional MMSE in a randomized trial involving 32 stable elderly residents of a nursing home and 16 elderly residents of a chronic care hospital unit.[2] One-way analysis of variance was used for the comparison. Intrarater variance was lower by 86% and inter-rater variance by 76% in all instances with the SMMSE compared with the MMSE. These reductions were significant (P <.003). The intraclass correlation coefficient was 0.69 for the MMSE and 0.90 for the SMMSE. In another study, the reliability of various instruments used in a series of double-blind N-of-1 clinical trials involving patients with Alzheimer's disease (AD) was compared when instruments were administered at home or at a clinic.[3] The intraclass correlation coefficient for the SMMSE was 0.86 at home and 0.92 in a clinic.

Validity of the SMMSE has been examined in two different studies. In one study, 184 older adults presenting with memory loss were assessed using the SMMSE and the Dysfunctional Behaviour Rating Instrument (DBRI).[4] There was a negative correlation between SMMSE and DBRI scores because the lower the cognitive function the greater the dysfunctional behaviour. The intraclass correlation coefficient was modest (r = - 0.43). In another study of 96 older adults, we examined the validity of five different processes for measuring capacity to complete an advance directive.[5] Two reference standards, consultant geriatricians, and a Competency Clinic assessment were compared with three screening instruments: a generic instrument and specific instrument for this particular advance directive, and the SMMSE. The area under the "receiver operating characteric" curve relating results of the three screening instruments to the Competency Clinic assessment were 0.82 for the generic instrument, 0.90 for the specific instrument, and 0.94 for the SMMSE.

Administration and scoring

The SMMSE can be used in various settings including patients' homes, doctors' offices, community clinics, acute care settings, and long-term care facilities. Physicians should be alert to the warning signs of serious cognitive impairment in their patients. Patients and families report changes in memory; patients repeatedly telephone for the same information, turn up on the wrong day or at the wrong time, or miss appointments completely. They forget instructions, fail to comply with medications, or get lost driving. They repeat themselves and require instructions to be written down or repeated many times. When memory loss is progressive or starts to affect behaviour or function, family doctors should screen patients with the SMMSE.

To ensure valid and reliable results, physicians should follow the standardized guidelines when administering the test.[6] **Table 1** shows the stages of

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cognitive impairment that relate to SMMSE scores. A total score of 30 indicates no impairment. Scores between 26 and 30 are considered normal in the general population. Patients who score between 25 and 20 have mild cognitive impairment and will be experiencing problems with the instrumental activities of daily living, such as shopping, finances, medication use, and meal preparation, but can usually live on their own with support. Those who score between 20 and 10 have moderate cognitive impairment, usually cannot live independently, and are starting to have problems with basic activities, such as grooming, dressing, and using the toilet. Scores between 9 and 0 denote severe cognitive impairment; patients will be having problems with all basic activities, including eating and walking. **Table 2** shows SMMSE scores and related functional impairments.

Interpreting results

Scores must be properly interpreted. Accurate assessment leads to accurate scoring. To ensure valid and reliable scoring, physicians can refer to booklets on the SMMSE, a user's guide, and a training video.[7,8] Using these aids will ensure consistent scoring and results not only when tests are repeated by the same physician but also when they are used by various other health care services, such as hospitals and day programs.

Some patients cannot complete test items due to physical disability. For example, blind people cannot identify a watch or a pencil, read a command, write a sentence, or copy a diagram (5 points). Items that patients cannot complete should not be included in the total score. The SMMSE is scored out of the items that can be tested, which in this example would be 25. People who have had strokes that have affected their dominant hands cannot copy diagrams or write sentences. The three-step instruction can be adapted by asking the person to "take the paper in your strong hand, crumple the paper into a ball, and drop it on the floor."

Age and level of education affect SMMSE scores. The mental status scores of adults of similar ages will vary according to their level of education.[9] A 78-year-old patient with 4 years' education will get a significantly lower score than another patient of the same age with a college degree.

Highly educated patients sometimes score higher than their level of function suggests. We would expect a recently retired schoolteacher to score 30. Colleagues notice, however, that she has trouble organizing her volunteer work. Although she scores 27/30 (in the "normal" range) on the SMMSE, she likely has some cognitive impairment.

Patients with little education or with language problems might score lower than their function suggests. An immigrant farmer who partially completed grade school scores 25 on the SMMSE, but he continues to run his farm successfully. Despite scoring below the "normal" range, he likely has no serious cognitive impairment.

As cognitive skills and SMMSE scores fall, independence in daily living also declines. An apparent discrepancy between SMMSE score and level of function is referred to as a "disability gap."[10] This could have several causes that should be investigated further. Patients who are depressed or are suffering an acute illness, or who are dehydrated, in pain, or delirious might score lower on the SMMSE than their function suggests. Targeted history, examination, and workup could reveal a treatable cause for this cognition-function discrepancy. Analyzing the pattern of deficits with the SMMSE in conjunction with history and physical examination can help to differentiate

Table 1. Progression of cognitive impairment in Alzheimer's disease

SCORE	DESCRIPTION	STAGE	DURATION (Y)
30-26	Could be normal	Could be normal	Varies
25-20	Mild	Early	0 to 2-3
19-10	Moderate	Middle	4-7
9-0	Severe	Late	7-14

Table 2. Areas of functional impairment

SCORE	ACTIVITIES OF DAILY LIVING	COMMUNICATION	MEMORY
30-26	Could be normal	Could be normal	Could be normal
25-20	Driving, finances, shopping	Finding words, repeating, going off topic	Three-item recall, orientation to time then place
19-10	Dressing, grooming, toileting	Sentence fragments, vague terms (ie, this, that)	Spelling WORLD backward, language, and three-step command
9-0	Eating, walking	Speech disturbances, such as stuttering and slurring	Obvious deficits in all areas

between AD, vascular disease, dementia with Lewy bodies, and depression.[11]

Alzheimer's disease. Patients with AD usually present with poor short-term memory.[12,13] Caregivers report that patients repeat stories and questions. Often the first deficit to appear on SMMSE screening is with recent memory. Patients cannot recall the three items registered in the Short-Term Recall component. In many cases, they will not even recall being asked to remember the three items. The next deficits usually appear in orientation to time and then place. Patients who have insidious onset of memory loss with progressive decline, who repeat stories and questions, and who cannot properly remember the three items probably have AD. Speech and language problems usually appear in the later stages of AD.[14] Patients with AD usually try to answer the questions on the SMMSE and often become frustrated if their deficits are pointed out.

Vascular dementia. Patients with vascular dementia usually have a mixed presentation of deficits when screened with the SMMSE. History often reveals that onset of symptoms is more sudden and fluctuates.[15] Patients often have a medical history of transient ischemic attacks, hypertension, angina, or stroke. Speech and language problems occur earlier and depression is more common than in AD because patients have preserved insight into deficits.[16,17] Incontinence, gait disturbances, apraxia, and perceptual problems, seen early in patients with vascular dementia, are usually not present until the later stages of AD. Computed tomography will often show stroke or white matter changes. When screened with the SMMSE, these patients do not usually show deficits in short-term memory first as patients with AD do; they are more inclined to have changes in speech and language function, such as naming objects and following the three-step command.

Dementia with Lewy bodies. Patients with this condition often demonstrate fluctuations in cognition and transient reductions in level of consciousness.[18] These fluctuations occur for minutes or for days and are not like the more steady, gradual decline seen in AD. Recurrent visual hallucinations, paranoia, and delusions are an early or even presenting feature of dementia with Lewy bodies. Other clinical features include parkinsonism with rigidity or bradykinesia and a shuffling, listing gait; resting tremors are uncommon.[19] Patients with dementia with Lewy bodies screened with the SMMSE might demonstrate reduced verbal fluency and visuospatial and constructional abilities, as evidenced by problems with drawing the two five-sided figures.[20] This constructional deficit often does not occur in AD until the middle stages. **Table 3** shows the initial deficits that can be apparent in the early stages of the types of dementia discussed.

Depression. Patients experiencing depression demonstrate apathy and indifference or refuse to try and answer SMMSE questions. Depressed patients are more likely to answer, "I don't know" or "It doesn't matter." They often complain openly of memory loss. They might say, "See, I told you I can't remember" or "I can't do it." When pressed, however, they often know the answer. They also have more somatic complaints, such as dyspepsia, or complain that "something is wrong inside me that the doctor cannot find."[21] They usually have a disability gap, scoring lower on the test but functioning independently in daily life. Both SMMSE scores and level of function should be checked because SMMSE scores used alone can lead to misdiagnosis of dementia rather than depression. Basic daily functioning can be assessed using the Lawton Scale[22] or the Barthel Index.[23]

If depression is suspected, ask about vegetative signs, such as changes in appetite and energy level,

Table 3. Initial deficits that can be assessed by components of the SMMSE: Alzheimer's disease, vascular disease, dementia with Lewy bodies

SMMSE COMPONENTS	ALZHEIMER'S DISEASE	VASCULAR DEMENTIA	DEMENTIA WITH LEWY BODIES
1-5 Orientation to time	X		
6-10 Orientation to place	X		
11 Repeat three objects			
12 Spelling WORLD backward			X
13 Recall three objects	X	X	X
14,15 Recognize objects		X	
16 Recognize idiom			
17 Close your eyes		X	
18 Copy a design		X	X
19 Write a sentence		X	
20 Three-step command		X	

weight loss, sleep disturbances, decreased libido, and suicidal thoughts. A standardized instrument, such as the Geriatric Depression Scale,[24] can help quantify level of depression.

Careful assessment of cognition and mood is important because depression can, on the surface, masquerade as dementia.[25] Also, diagnoses of AD, vascular dementia, dementia with Lewy bodies, or depression are not mutually exclusive and can present simultaneously in any combination. When dementia is diagnosed, it is recommended that legal issues, such as powers of attorney and advance health care directives, be prepared. The SMMSE not only provides a global score that can help assess the dementia, but it can be repeated to monitor changes in cognition, to measure efficacy of treatment, and to help predict prognoses and need for caregiver support.

Limitations of the SMMSE

The SMMSE was developed for English-speaking patients. People from other cultures might not recognize common expressions, or spell or write in English. The test is not reliable when administered through an interpreter or to an aphasic patient. Assessors should note any deficits that could lower scores and limit interpretation of results.

The SMMSE should not be used in isolation to develop a diagnosis. A detailed family history, medication review, physical examination, history of cognitive decline, and presenting complaints are all part of a comprehensive assessment. The SMMSE has a ceiling effect in early dementia. It is not sensitive enough to pick up very mild cognitive changes. For these, the Cognitive Competency Test[26] could provide more detailed information.

Conclusion

The SMMSE is a reliable instrument that allows practitioners to accurately measure cognitive deficits and deterioration over time. It can be used in a variety of clinical settings. It can help explain why difficulties exist in certain areas of daily functioning. It provides a useful screen of cognitive abilities that can lead to effective treatments to maximize cognition and function. If in doubt about the importance of a mild memory problem, patients can be retested yearly or every 6 months. Serial SMMSE scores provide an accurate measurement of change in mental function over time and help to measure response to treatment.

Competing interests
None declared

Editor's key points

- The Standardized Mini-Mental State Examination (SMMSE) is a valid and reliable instrument widely used to screen cognitively impaired elderly people.
- The SMMSE must be carried out according to protocol and with allowances for other physical or mental conditions.
- Interpretation of results should take into account patients' education and the wider context of their financial and social status in the community.
- Patterns of answers could suggest various causes of dementia, such as Alzheimer's disease, vascular dementia, Lewy bodies, or depression.

Points de repère du rédacteur

- Le mini-examen de l'état mental normalisé (SMMSE) est un instrument valide et fiable communément utilisé pour dépister les personnes âgées souffrant de déficiences cognitives.
- Il faut administrer le SMMSE conformément au protocole et évaluer la possibilité d'autres conditions physiques ou mentales.
- L'interprétation des résultats devrait tenir compte de l'éducation des patients et du contexte plus large de leur situation financière et sociale dans la communauté.
- Des modes de réponses pourraient laisser présager diverses causes de démence comme la maladie d'Alzheimer, la démence vasculaire, les corps de Lewy ou la dépression.

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