The Mini-Mental Status Exam: As Easy as 1 - 2 - 30

A learning companion to the revised QE II SMMSE.

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It is not an uncommon scenario for a primary care physician to manage a patient who complains that their memory is not what it used to be. A common practice in such a case is to screen for cognitive impairment using the mini-mental status exam (MMSE), first introduced by Folstein in 1975. How useful is a screening test if it is administered and scored in a non-standardized fashion? A committee at the Queen Elizabeth II Health Sciences Center met recently to address this concern. Presented in the format of a case vignette, this paper will review the current recommendations that were reached regarding the administration and scoring of the MMSE and will afford the reader a comprehensive approach to screening for dementia.

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Case Vignette

Mr. John Smith is a 63-year-old gentleman that has recently come under your care. He complains that his memory is "not quite like it used it to be". In his weekly poker game he has been noticing that he sometimes forgets how to score his hand and admits to having recent difficulties building model airplanes with his grandson. His wife of forty years is worried because John has had increasing difficulty finding the right word, something the former English teacher has never had a problem with. You decide that a Mini Mental Status Examination (MMSE) is warranted.

Introduction

Objective cognitive screening of at risk patients is an important component of health care. It enables early detection and monitoring of cognitive decline and serves as a catalyst to early intervention. It is paramount that the health care provider be able to accurately screen the cognitive ability of a patient.

The Mini Mental Status Examination (MMSE) is considered to be a useful tool to assess cognitive function and is currently in widespread use. The MMSE was developed in the early 1970s by Folstein.[1] The intent was to create a valid test of cognitive function that would be much shorter than the available tests. The elderly population, suspected of having dementia, is much more likely to cooperate for the 10 minutes it takes to properly administer and score the MMSE than for a lengthy test.

The MMSE serves as a useful cognitive screening test that will indicate the necessity for further assessment and is not intended for the purpose of diagnosis. A test that is quick and easy to administer is also more amiable to the health care worker administering the test. It may be used to document change in cognitive function over time, if scored

in a standardized fashion.[2]

The MMSE briefly inspects important elements of cognitive function, including orientation to time and place, registration, attention and calculation, short-term recall, language and visual construction. Of note, there is more emphasis on verbal ability than visuospatial function. The MMSE quantifies the ability of the patient in the domains of cognitive function with a maximum score of 30.

A screening test is valid only if it is both specific and sensitive. A test is considered sensitive if it identifies patients that have a cognitive impairment. In order for the MMSE to be considered a test with high specificity it must not identify patients as having a cognitive impairment if they indeed do not. Since the MMSE was devised, numerous investigators have tested the validity of the test by comparing it to the gold standards of diagnosis. It is accepted that the MMSE is a valid screening tool for dementia.[3]

Critical to the assessment of the validity of the test are the cut off scores used to quantify the level of cognitive impairment. In 70% of the studies reviewed by Tombaugh, a MMSE score of less than 23 was associated with a diagnosis of dementia in at least 79% of the cases.[3] In the same review it was mentioned that in most studies a score of greater than 23 readily identified the members of the control group. For these reasons it has been recommended that a score of 24 – 30 be accepted as normal.

However, when scoring the MMSE it is important to realize that there are factors that are independent of actual cognitive impairment that may play a role in the score attained. If the subject has an educational level lower than grade 8 the validity of the test decreases. These subjects will score lower than average, although they may not be cognitively impaired. Subjects with higher education levels may be able to disguise mild levels of cognitive dysfunction and this also needs to be taken into account when looking at a MMSE score. Ethnicity may play a role, although there is contradictory evidence regarding this. The average MMSE

score decreases with increasing age, beginning at about age 55 or 60. The MMSE is a test that does not discriminate based on gender, meaning that the average score is not affected by the sex of the subject. The MMSE has been validated for use in other languages and should be administered using the patient's first language. [3]

A hallmark of dementia is cognitive impairment, and this may be reflected in scores below 24 on the MMSE. So while a low score on the MMSE may clue the health care provider to an underlying dementia, it is important to realize that there are other causes of cognitive impairment that need to be considered. One should always be aware that the person with a low MMSE score may have a delirium. The clinical picture is usually very helpful in discriminating between a delirium and a dementia. A delirium usually has an abrupt onset, an acutely fluctuating course punctuated by lucid moments and a generalized reduction in alertness and attention. It is important to rule out delirium as it often has reversible cognitive deficits.

An issue of concern with the MMSE is the variability in the way that it is administered and scored. The Standardized Mini Mental State Exam (SMMSE) developed by Malloy is virtually the same test as the original MMSE developed by Folstein.[4] The only difference is that the SMMSE provides clear and explicit administration and scoring guidelines. It has been shown to have lower intra-rater variability and inter-rater variance when compared to the MMSE, and therefore is considered a preferred method of administration.

At the Queen Elizabeth Health Science Center (QEII) we have developed a cognitive screening test that combines elements of the SMMSE and MMSE. We will briefly overview how to correctly administer and score the QEII SMMSE.

Using the QE II SMMSE[5]:

Establish rapport with the patient and ensure that the patient can hear you. When asking questions it is important not to provide hints or physical clues such as nodding one's head. However, it is appropriate to encourage the patient to complete the exam. A question can be asked a maximum of three times and the phrasing of the question should remain the same. If the patient goes over the time limit allow them to answer the question, but do not give them value for it.

Orientation
(allow 10 seconds for each reply)

A question answered correctly is worth 1 point, incorrect answers are scored 0.

- **What year is this?** Accept exact answer only.
- **What season is this?** During the last month of the old season, or the first month of the new season, accept either season.
- **What month of the year is this?** On the first day of a

new month, or the last day of the previous month, accept either month.
- **What is today's date?** Accept the preceding or the following date, e.g. on the 7th accept the 6th or the 8th.
- **What day of the week is this?** Accept exact answer only.
- **What country are we in?** Accept exact answer only.
- **What province are we in?** Accept exact answer only.
- **What town/city are we in?** Accept exact answer only.
- **What is the name of this hospital?** Accept exact answer only.
  Alternate: What is the street address of this house?
- **What floor are we on now?** Accept exact answer only.
  Alternate: What room of the house are we in?

Registration, Calculation and Short Term Memory

- Say: **I am going to name 3 words. After I have said all 3 words, I want you to repeat them. Remember what they are because I am going to ask you to name them again in a few minutes.**

Ball   Car   Man

Score 1 point for each correct reply on the first attempt for a maximum score of 3 points. The words may be administered up to 5 times for perfect registration, but the score is based only on the first trial.
Standardized alternatives: Bell, Jar, Fan / Bill, Tar, Can / Bull, War, Pan

- **Spell WORLD; now spell WORLD backwards.**

The patient should know how to spell the word 'world' before being asked to spell it backward. The patient can get help with the correct spelling. If the patient is unable to spell 'world' without assistance, the score is zero.

The task of spelling world backward is worth 5 points and accounts for 17% of the total score. Assuring standardized scoring of this task is very important and will substantially improve inter-rater reliability of the QEII MMSE. There are a variety of methods used to score this test, the following method is simple, objective and easy to teach. Simply count the number of correct letters <u>before</u> the first mistake.

Correct: D L R O W   Score = 2
Patient: D L <u>O</u> R W

An alternate to spelling world backwards is the test of serial sevens. The patient is asked: **Subtract 7 from 100 and keep subtracting 7 from what is left**. Do not interrupt the patient and allow him/her to proceed until five subtractions have been made. When scoring the results, errors can <u>not</u> compound. For every correct subtraction of 7 the patient receives 1 point.

93 — 86 — 79 — 72 — 65   5 points
93 — 85[*] — 78 — 71 — 64   * 1 mistake = 4 points

Research has shown that spelling 'world' backwards consistently produces higher scores than does serial sevens. Basically this means that the tests are not comparable and should not be used interchangeably. To ensure standardization it is suggested by some that both tests should be administered and the test yielding the highest score used. Currently at the QEII, the examiner only uses the 'world' test.

- **What were the 3 words?**
  Score 1 point for each correct response, regardless of order.

Language, Spatial Orientation and Coordination

A question answered correctly is worth one point, incorrect answers are scored zero.

- Show Wristwatch – **What is this called?**
  Accept wristwatch or watch only
- Show pencil (pen) – **What is this called?**
  Accept pencil (pen) only
- Ask the patient to: **Repeat this phrase after me, "No ifs ands or buts"**. Repetition must be exact
- Show the patient an enlarged command and instruct the patient to: **Read the words on the page and do what it says.**
  Show the patient the card that reads, "CLOSE YOUR EYES" in enlarged letters. Allow the patient 10 seconds to complete the command. If the patient does not close eyes, repeat instructions up to 3 times. Score 1 point only if he/she closes eyes.
- Ask if patient is right or left handed and ask the patient to:
  Take this paper in your right/left hand (opposite to dominant hand), fold in half once with both hands and put the paper down on the floor
  Allow the patient 30 seconds to complete the task and score 1 point for each instruction correctly executed. It is important not to lead the patient by offering the paper to the non-dominant hand.
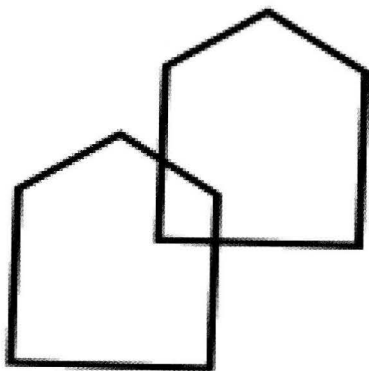
Figure 1. Intersecting pentagons.

- Give the patient a pencil and paper and ask the patient to:
  Write a sentence
  Allow the patient 30 seconds to complete the task and score 1 point if the sentence contains a subject, verb and object and makes sense. Ignore spelling errors and handwriting.
- Place design, pencil, and paper in front of the patient and ask the patient to:
  Copy this design.
  Allow the patient 30 seconds to complete the task. 1 point is given if the intersecting pentagons create a 4-sided figure (Figure 1).

The Clock-Drawing Test

As a screening tool, the MMSE does a good job of assessing most types of cognitive function. However, it does a relatively poor job of testing frontal lobe or executive function. In order to compensate for this deficit the QEII MMSE can be complemented with a test that adequately assesses executive function, namely the Clock-Drawing Test (CDT). Apart from its role in documenting executive function, an abnormal CDT significantly increases the probability of dementia, and also evaluates visuospatial function. The clock-drawing test is particularly important in screening for dementias of the non-Alzheimer's types. These include alcohol-induced, HIV, vascular or subcortical dementias such as those related to Parkinson's, Huntington's and Pick's disease. All may score normally on the MMSE, but in reality there is significant cognitive impairment.[6]

Using the Clock-Drawing Test

The Clock-Drawing Test (CDT) can be quickly administered in 2 minutes. Published studies, up to and including 1998, show that the mean sensitivity and specificity of the CDT is 85% despite variability in the administration and scoring of the test.[6]

When administering the CDT the patient should be asked to **draw a clock and put in the numbers; set the time to ten minutes past eleven**. The examiner should not use the word 'hands' in the instructions. The time 11:10 is particularly useful because it involves both visual fields and invokes the 'frontal pull'. The frontal pull is the tendency that one has to be influenced by perceptual features of the stimulus. This requires the patient to think in the abstract, that is, to point the hand at the '2' instead of the '10'.

Currently the clock-drawing test is not a necessary component of the cognitive screening test at the QEII. However, we feel that the CDT is a good adjunct to the MMSE. The following scoring system, devised by Shulman, is provided as it shows examples of common difficulties in clock drawing.[7]

The examiner observes the clock that is drawn and checks for symmetry, organized number placement and use of hands to properly represent the time of 11:10.

Score	Drawing	Description
5		perfect clock
4		minor visuo-spatial errors
3		inaccurate time, otherwise fine
2		moderate visuo-spatial errors
1		severely disorganized
0		inability to represent clock

Figure 2. Clock-Drawing Test Scoring. Adapted from page 552 of Schulman K.I. Clock-drawing: Is it the ideal cognitive screening test? Int J Geriat Psychiatry 2000; 15: 548-561.

Case Vignette

After establishing a good rapport with Mr. Smith you administer the QEII SMMSE and the clock-drawing test. In the orientation section of the test he quickly answers all questions with no difficulty. He correctly registers and repeats ball, car, and man. Mr. Smith spells world backwards D L R W. You then ask Mr. Smith to repeat the three words you had asked him to remember. He is able to remember 'man' and 'car', but is unable to remember 'ball'. When pointing to your wristwatch, Mr. Smith stumbles a bit and blurts out "clock". When shown a pencil he states that it is a pen. Mr. Smith has no problem repeating the phrase, "no ifs, ands or buts". Mr. Smith is unable to close his eyes when shown the card. You fold a paper in half once with both hands and put the paper on the floor. He takes a paper from you in his non-dominant hand before folding it in half and placing it on the floor. When asked to write a sentence Mr. Smith writes: Please make my memory work better. Mr. Smith's pentagons are included, he completed the task in approximately 30 seconds(Fig.3). The clock he drew is also included(Fig.4).
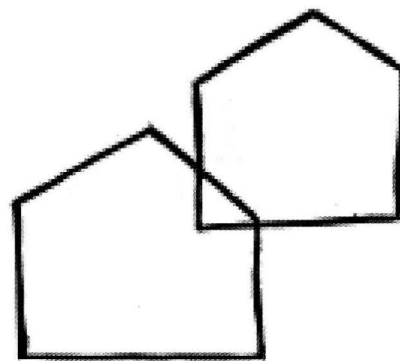
Figure 3. Mr. Smith's intersecting pentagons.

How did you score Mr. Smith's QEII SMMSE test?
_____

When asked to draw a clock Mr. Smith draws the following:
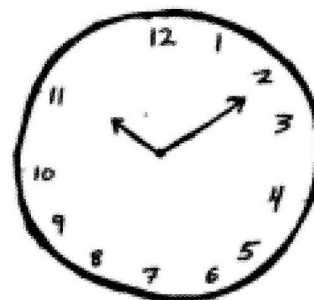
Figure 4. Mr. Smith's clock.

How did you score Mr. Smith's clock? _____

Summary

The MMSE is an established, valid screening tool used to screen for cognitive impairment. When scored in a standardized fashion it may be useful in documenting cognitive decline over time. It is quick and easy to use. The QEII SMMSE is the same as the MMSE, but revised in the sense that it utilizes a well-defined method of administration and scoring criteria that make it more reliable.

You decide to use the QEII SMMSE to evaluate Mr. Smith. You carry out the test on Mr. Smith and he scores a 23. On further questioning Mr. Smith acknowledges that he has taken that test before. Three years ago, his oldest brother was diagnosed with Alzheimer's disease and he figured that he should get himself checked out. His family doctor reassured him that even though there is some evidence of an hereditary component to Alzheimer's disease he was probably fine since he was having no symptoms. He applauded Mr. Smith for coming into the office and administered the MMSE. You call the office of the family doctor and discover that Mr. Smith scored a 29/30 on the MMSE at that time. You wonder if the family doctor used the QEII SMMSE format and if the current

score truly reflects cognitive decline over time, or is it simply an artifact of the test being administered and scored differently from the QEII SMMSE?

As it turns out, Mr. Smith's doctor used the administration and scoring format highlighted above. Mr. Smith also drew a perfect clock. The test administered today shows evidence of mild cognitive impairment, and is consistent with a decline from his test three years ago. You are wary because you know that the educational level or Mr. Smith is such that he may be able to mask mild cognitive impairment and may actually have a cognitive deficit more pronounced than revealed by the QEII SMMSE. Mr. Smith's clock score has declined from a perfect clock two years ago to a 4. It is evident to you that on initial screening Mr. Smith has cognitive impairment and a more formal investigation is required.

About The Author

Chris Murphy is the oldest of ten children. He was born and raised in Yarmouth, Nova Scotia. He completed an Honours B.Sc. in Chemistry at Saint Francis Xavier University before starting medical school. He has taken part in Helping Hands Medical Missions in Mexico and Brazil. He intends to return to his hometown to practice surgery or family medicine.
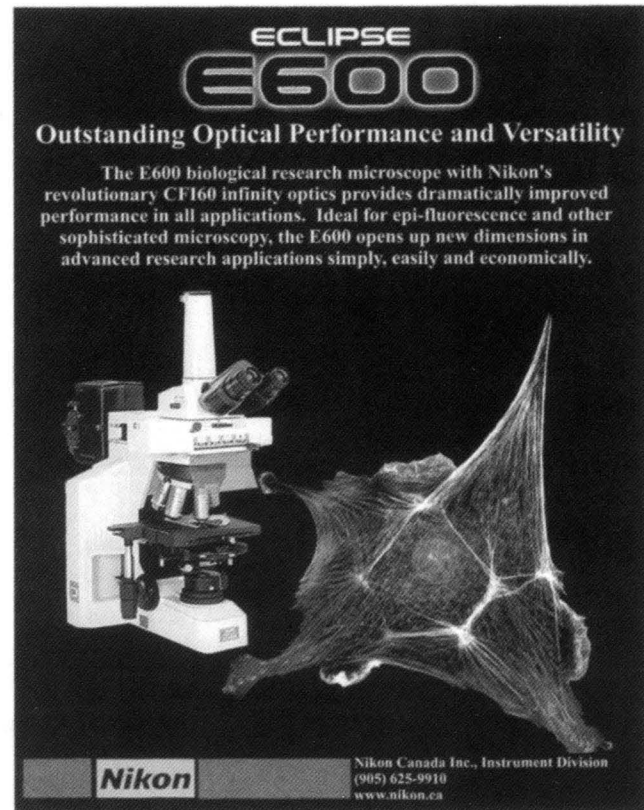
Conclusion

The MMSE is a useful screening tool for cognitive impairment when used correctly in a standardized fashion. There are inconsistencies in the way the MMSE is administered, scored and interpreted. These discrepancies have been addressed by the Centre for Health Care of the Elderly Data Committee at the QEII, culminating in the creation of the QEII SMMSE. By following the recommendations outlined in this paper it is our intention that the medical community will become more aware of how to correctly use the QEII SMMSE to screen for cognitive impairment.

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