Geriatric Resident Rounds: Adaptation of Cognitive Testing in Sensory Impairment

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Objectives

1. Highlight the importance of validated cognitive screening tools for the visually/hearing impaired

2. Briefly review common conditions associated with visual and hearing impairment in the elderly

3. Present and discuss two relevant papers

4. Discuss alternatives and “tricks of the trade”
Why is this important?

- Visual impairment is **common** in elderly populations
  ~ 12% in those >75 years old\(^1\)

- Dementia is **more common** in the visually impaired
  Odds Ratio = 2.88 compared to those with normal vision\(^2\)

- There is a **scarcity** of data identifying appropriate screening methods in hearing impaired older adults
Why is this important?

- Dementia decreases quality of life and shortens life spans.
- Potential Years of Life Lost\(^3\)
  - Dementia (3.4)
  - CVD (3.6)
  - Cancer (4.1)
- Dementia, once recognized, is manageable
Case #1

- 81 yo male, presents with his son who has concerns that his father is becoming “forgetful”, often repeats stories and gets lost when going for walks.

- PMHx: bacterial meningitis at 9 months of age and has been deaf since
Causes of Hearing Impairment in the Elderly

- Conductive
  - Wax/foreign body
  - Perforated eardrum (trauma, pressure, infection)
- Osteosclerosis
- Chronic otitis media
Causes of Hearing Impairment in the Elderly

- Sensorineural
  - Presbycusis
  - Ototoxic drugs
  - Acoustic neuroma
  - Meniere’s Disease
Clinical Evaluation of the Mini-Mental State Exam with Culturally Deaf Senior Citizens

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Abstract

The Mini-Mental State Exam (MMSE) is commonly used to screen cognitive function in a clinical setting. The measure has been published in over 50 languages; however, the validity and reliability of the MMSE has yet to be assessed with the culturally Deaf elderly population. Participants consisted of 117 Deaf senior citizens, aged 55–89 (\(M = 69.44, SD = 8.55\)). Demographic information, including state of residence, age, and history of depression, head injury, and dementia diagnoses, were collected. A standard form of the MMSE was used with modification of test administration and stimuli including translation of English test items into a sign-based form and alteration of two items in order to make them culturally and linguistically appropriate. Significant correlations were observed between overall test score and education level (\(r = .23, p = .01\)) as well as test score and age (\(r = -.33, p < .001\)). Patterns of responses were analyzed and revealed several items that were problematic and yielded a lower correct answers. These results indicate that clinicians need to be aware of cultural
Purpose

“Evaluate how [culturally] Deaf individuals perform on the MMSE with minimal changes made to the structure of item instruction”
Participants

- All participants were congenitally deaf or prelingually deaf and identified ASL as 1° language

- Exclusion criteria
  - Late deafness (post lingual)
  - Head injury
  - Prior diagnosis of dementia or depression
Participants

- Participants recruited from the Deaf Seniors of America conference in San Francisco (2005)
- n=117
  - Male=33, Female = 84
- Mean age = 69.4 years
- Average education = 13.8 years*
Methods

- Demographic questionnaire (self reported)

- MMSE modifications:
  - Translated to ASL
  - “cat, tree, house”
    - Analogous frequency of words
    - No ASL word for “penny”
    - Hand gestures are distinct
  - After “Close your Eyes” task, pt tapped on shoulder rather than told verbally to open
Results

Distribution of Total MMSE Score by percent.
## Results

Table 1. Frequency of responses

<table>
<thead>
<tr>
<th>Cognitive domain</th>
<th>Test item</th>
<th>% Incorrect</th>
<th>% Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientation</td>
<td>Year</td>
<td>2.6</td>
<td>97.4</td>
</tr>
<tr>
<td></td>
<td>Season</td>
<td>0</td>
<td>100.00</td>
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<tr>
<td></td>
<td>Date</td>
<td>27.4</td>
<td>72.6</td>
</tr>
<tr>
<td></td>
<td>Day of week</td>
<td>8.5</td>
<td>91.5</td>
</tr>
<tr>
<td></td>
<td>Month</td>
<td>10.3</td>
<td>89.7</td>
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<tr>
<td></td>
<td>State</td>
<td>2.6</td>
<td>97.4</td>
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<tr>
<td></td>
<td>City</td>
<td>3.4</td>
<td>96.6</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>6.8</td>
<td>93.2</td>
</tr>
<tr>
<td></td>
<td>President</td>
<td>2.6</td>
<td>97.4</td>
</tr>
<tr>
<td></td>
<td>Governor</td>
<td>23.1</td>
<td>76.9</td>
</tr>
<tr>
<td>Registration</td>
<td>Imm. Rel Cat</td>
<td>0.9</td>
<td>99.1</td>
</tr>
<tr>
<td></td>
<td>Imm. Rel Tree</td>
<td>9.4</td>
<td>90.6</td>
</tr>
<tr>
<td></td>
<td>Imm. Rel House</td>
<td>0.9</td>
<td>99.1</td>
</tr>
<tr>
<td>Attention/calculation</td>
<td>Serial 7's</td>
<td>83.8</td>
<td>16.2</td>
</tr>
<tr>
<td></td>
<td>World</td>
<td>8.5</td>
<td>91.5</td>
</tr>
<tr>
<td>Recall</td>
<td>Delay Rel Cat</td>
<td>13.7</td>
<td>86.3</td>
</tr>
<tr>
<td></td>
<td>Delay Rel Tree</td>
<td>15.4</td>
<td>84.6</td>
</tr>
<tr>
<td></td>
<td>Delay Rel House</td>
<td>12.0</td>
<td>88.0</td>
</tr>
<tr>
<td>Language</td>
<td>Watch</td>
<td>8.5</td>
<td>91.5</td>
</tr>
<tr>
<td></td>
<td>Pencil</td>
<td>0.9</td>
<td>99.1</td>
</tr>
<tr>
<td></td>
<td>Repetition</td>
<td>78.6</td>
<td>21.4</td>
</tr>
<tr>
<td></td>
<td>Reading</td>
<td>3.4</td>
<td>96.6</td>
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<tr>
<td></td>
<td>Command: Right</td>
<td>37.6</td>
<td>62.4</td>
</tr>
<tr>
<td></td>
<td>Command: Fold</td>
<td>12.8</td>
<td>87.2</td>
</tr>
<tr>
<td></td>
<td>Command: Lap</td>
<td>11.1</td>
<td>88.9</td>
</tr>
<tr>
<td></td>
<td>Sentence generate</td>
<td>22.2</td>
<td>77.8</td>
</tr>
<tr>
<td></td>
<td>Copy</td>
<td>16.2</td>
<td>83.8</td>
</tr>
</tbody>
</table>

Notes: Items in bold represent task frequencies of less that 85% correct and potentially problematic.

*The frequencies presented for “World” represent scores of 0 or 5 and thus do not add up to 100%.*
Results

- Mean Score = 25.9 +/- 3.5
  - below acceptable cutoff for “normal”
  - Comparable to those with Eighth Grade Education from previous studies
- 6% of people scored below 19
  - signifies severe cognitive impairment
- Scores correlated to age (-) and education (+)
- Age of ASL acquisition not correlated to scores
Limitations

- Methods selected for:
  - a highly educated and high functioning population
  - Individuals with a strong sense of “Deaf Culture”

- Self reporting of past medical hx

- No evidence for validity in those with post-lingual hearing loss
Conclusions

- Un-modified MMSE may grossly underestimate cognitive performance in hearing impairment individuals (risk of false + test)

- At this point the MMSE is inappropriate for cognitive screening of older, deaf adults

- Future research required which would more likely represent cultural norms with respect to ethnic diversity and level of education
Case #2

- 77 yo female presents with granddaughter after a 6 month decline in functioning and occasional “confusion” in the evenings.

- PMHx: poorly controlled Diabetes for past ~25 years
Causes of Visual Impairment in the Elderly

- Age Related Macular Degeneration
- Glaucoma
- Cataract
- Diabetic Retinopathy
Macular degeneration
Glaucoma
Cataracts
Diabetic Retinopathy
Adaptation of dementia screening for vision-impaired older persons
Administration of the Mini-Mental State Examination (MMSE)

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Abstract

In epidemiologic field studies on the prevalence and incidence of dementia the problems associated with the cognitive testing of visually impaired individuals are rarely discussed. In the Leipzig Longitudinal Study of the Aged (LEILA 75+) a version of the Mini-Mental State Examination for the visually impaired (MMSE-blind) was employed from which all items requiring image processing had been omitted. To be able to interpret the test results and include vision-impaired individuals in the field study, the scores for the full MMSE were estimated by conducting linear transformation of the scores obtained on the MMSE-blind. The method of linear transformation is based on certain theoretical assumptions that are examined in this article. Linear transformation of scores has proved to be a valid procedure only for individuals with very high or very low cognitive performance. Thus, evaluation of the estimated full MMSE scores based on the norms for the original MMSE is not recommended. A blind version of the MMSE with age- and education-specific norms that has been validated as a screening tool for dementia is therefore presented. © 2002 Elsevier
Historical Perspective

- Folestein (1973) – Journal of Psychiatric Research
  - "because of the reading and writing involved in Part II, patients with severely impaired vision may have some extra difficulty that can usually be eased by large writing and allowed for in the scoring"

- Jagger (1992) – Age and Ageing
  - Visual impairment can also result in low MMSE scores in those without clinical signs of dementia
Reischies & Geiselmann (1997) reported that omitting vision-dependant MMSE items does not reduce discriminative power of MMSE.

No effect of education reported.

Are other “vision independent” questions truly valid? This could imply that visually impaired patients are less likely to know the date/season/floor of the hospital due to the lack of visual stimuli.
Purpose

1) Assess validity of estimating full MMSE scores from a shortened version omitting all vision-dependant questions (MM-blind)

2) Are the responses to the MM-blind test actually vision independent?
Participants

- Population data used from the LEILA 75+ study (Germany)
- N=1136
  - Blind=88 (7.7%)
    - More likely to be older, female and less educated
- Exclusion criteria
  - “mental retardation”
  - Comorbid psychiatric disorders
Methods: Visual Assessment

0—no vision impairment (unimpaired vision with glasses, small print in newspapers can be read without difficulty)
1—mild degree of vision impairment (reading possible only with considerable effort, subject tires fast, only large print such as newspaper headlines can be read without effort)
2—moderate vision impairment (people and objects can be discerned, reading with a magnifying glass only)
3—severe vision impairment (only shadows discernible, differentiation of bright and darkness, blindness)
Methods

≥2 on visual survey + unable to recognize vision-depandant items on MMSE = MM-blind.

8 points eliminated (Max score =22/30)
- Naming (2)
- Read and obey sentence (1)
- Write a sentence(1)
- Copying (1)
- Three stage command(3)
Methods

- To score out of 30 – multiplied MMSE-blind scores by a constant quotient (30/22)

- 2 assumptions
  - Vision impairment does not influence test performance on MM-blind
  - Test difficulty of MM-blind is the same as MMSE
Results
Results

- No influence of vision impairment on item performance was found.

- Difficulties were not equivalent.
  - All eight vision-dependant items are “low difficulty” (70-100% correct).

- As with other studies, age (⁻) and education (⁺) correlated with scores.
Limitations

- Self reporting of degree of visual impairment (however, prevalence rates are approximately the same as population based studies)

- No raw data provided
Conclusions

- Linear transformation did not meet all the assumptions (ie equal difficulty) it **should not** be used.
  - Given the higher difficulty, it tends to underestimate performance.

- Vision had no effect on performance of the 22 MM-blind questions and therefore is a **valid** tool.
  - Compared results of blind/not blind on individual test items

- MM-blind **should not** replace the MMSE when appropriate
  - Performance on some areas may help differentiate etiology of dementia\(^6\)
Conclusions

- MM-blind could be useful for those with motor impairment or considerable weakness.

- Recommend cut-off scores of 15-17 depending on age and education (sensitivity >91%)
Alternatives

- Informant-based questionnaires
  - Functional Activities Questionnaire (FAQ)
  - AD8 questionnaire
## AD8 Screening Test

<table>
<thead>
<tr>
<th>Question</th>
<th>YES, A change</th>
<th>NO, No change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Problems with judgment (e.g., problems making decisions, bad financial decisions, problems with thinking)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Less interest in hobbies/activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Repeats the same things over and over (questions, stories, or statements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Trouble learning how to use a tool, appliance, or gadget (e.g., VCR, computer, microwave, remote control)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Forgets correct month or year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Trouble handling complicated financial affairs (e.g., balancing checkbook, income taxes, paying bills)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Trouble remembering appointments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Daily problems with thinking and/or memory</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remember, “Yes, a change” indicates that there has been a change in the last several years caused by cognitive (thinking and memory) problems.
Functional Activities Questionnaire

Rate the patient’s level of performance on each of the following tasks using this scale: 0 = normal; 1 = has difficulty but does by self; 2 = requires assistance; 3 = dependent.*

- Writing checks, paying bills, and keeping financial records (for example, balancing a checkbook)
- Assembling tax records and making out business and insurance papers
- Shopping alone for clothes, household necessities, or groceries
- Playing a game of skill (for example, bridge or chess) or working on a hobby
- Heating water for a cup of coffee or tea and turning off the stove
- Preparing a balanced meal
- Keeping track of current events
- Paying attention to and understanding a television show, book, or magazine
- Remembering appointments, family occasions, and medications
- Traveling out of the neighborhood (for example, driving or arranging to take buses)

Score: __________
Personal Experiences/Clinical Pearls?
References


