Cognitive Function and Frailty

Kaycee M. Sink, MD, MAS
Associate Professor of Medicine, Geriatrics
Director, Kulynych Memory Assessment Clinic
- Relationship between cognition and frailty
- Cognitive trajectories
- Defining cognitive impairment and dementia
- Tools for measuring cognition in your work
Relationship between cognition and frailty

Frailty    Cognitive impairment

Association holds both in cross section and longitudinally

Roberston, DA. Aging Research Reviews 2013
Cognitive Function is worse in Prefrailty and Frailty

Robertson et al. JAGS 2014

The Irish Longitudinal Study of Aging (TILDA) – strongest predictors of cognition were gait speed and muscle strength
Slow Gait Speed Predicts Cognitive Decline, but baseline cognition did not predict decline in gait.
Gait speed changes years before MCI conversion

204 participants in the Oregon Brain Aging Study

Relationship between cognition and frailty

Roberston, DA. Aging Research Reviews 2013
Worse cognition is associated with incident frailty

- 942 non-frail older Mexican Americans, having MMSE <21 at baseline resulted in greater odds of becoming frail (OR 1.09 (1.00-1.19) per year) c/w people with MMSE ≥21 Raji et al. J Gerontol A 2010

*HABC data* adjusted for baseline gait speed, age, race, sex, clinic

Frailty and Cognitive Impairment overlapping syndromes

Likely to be common pathophysiologic pathways

- Alzheimer’s disease pathology
  - CVD Risk factors
  - Chronic inflammation
- Lifestyle factors (physical inactivity)
  - Depression
What is Cognitive Frailty?

• Normal cognitive aging?
• Mild Cognitive impairment/ Pre-dementia?
• Cognitive vulnerability/ decreased reserve?
Cognitive resilience vs frailty

Proposed Definition of Cognitive Frailty

- International Consensus Group
  - **Goal was to identify a condition of cognitive impairment caused by physical conditions**

- Proposed definition:
  - Presence of both physical frailty and cognitive impairment (CDR 0.5)
  - Exclusion of concurrent Alzheimer’s dementia or other dementias

Cognitive trajectories

Ruan et al. Ageing Research Reviews 2015
MCI (mild cognitive impairment)
- Cognitive impairment in 1 or more domains
- Does NOT Interfere with work or usual activities
- Decline from previous baseline
- Not explained by delirium or major psychiatric d/o

Dementia
- Cognitive impairment in 2 or more domains
- Interferes with work or usual activities
- Decline from previous baseline
- Not explained by delirium or major psychiatric d/o

NIA/AA Criteria; Albert 2011; McKhann 2011
Cognitive Impairment is unrecognized or undocumented

Documentation of cognitive impairment in Primary Care is poor

• <50% of patients with dementia have the dx in chart
• <25% of patients with MCI have cognitive impairment noted in chart

• Use of Electronic Medical Records or health services data may not be adequate for your research – shocking!!

Measuring Cognition

- Global cognitive function
  - Mini-cog
  - MMSE, 3MSE, MoCA

- Domain specific cognitive functions
  - Memory
  - Executive function
  - Language
  - Processing speed
  - Visuospatial function
  - Concentration and working memory
Mini-Cog

• Very brief screening tool (3 minutes)
• 3 item recall and a clock draw
• Valid in culturally and educationally diverse groups

Boorson, et al. JAGS. 2003
Out with the old (MMSE)…. in with the new (MoCA)?

- Mini Mental State Examination (MMSE) published in 1975 by Folstein and Folstein
- Over the decades became the primary screening tool in practice for cognitive impairment
- Now copyright protected and should be purchased from Psychological Assessment Resources, Inc ($1.36 each)
Montreal Cognitive Assessment (MoCA)

Forms and Instructions available for free at:
www.mocatest.org

Nasreddine JAGS 2005
<table>
<thead>
<tr>
<th>MEMORY</th>
<th>Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FACE</td>
</tr>
<tr>
<td>1st trial</td>
<td></td>
</tr>
<tr>
<td>2nd trial</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ATTENTION</th>
<th>Read list of digits (1 digit/sec.). Subject has to repeat them in the forward order Subject has to repeat them in the backward order</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ] 2 1 8 5 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ATTENTION</th>
<th>Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ATTENTION</th>
<th>Serial 7 subtraction starting at 100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ] 93</td>
</tr>
</tbody>
</table>

4 or 5 correct subtractions: 3 pts, 2 or 3 correct: 2 pts, 1 correct: 1 pt, 0 correct: 0 pt

<table>
<thead>
<tr>
<th>LANGUAGE</th>
<th>Repeat: I only know that John is the one to help today.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ] The cat always hid under the couch when dogs were in the room.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LANGUAGE</th>
<th>Fluency / Name maximum number of words in one minute that begin with the letter F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ] ____ (N ≥ 11 words)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ABSTRACTION</th>
<th>Similarity between e.g. banana - orange = fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ] train - bicycle</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DELAYED RECALL</th>
<th>Has to recall words</th>
</tr>
</thead>
<tbody>
<tr>
<td>WITH NO CUE</td>
<td>FACE</td>
</tr>
</tbody>
</table>

Optional

Category cue

Multiple choice cue

| ORIENTATION | [ ] Date | [ ] Month | [ ] Year | [ ] Day | [ ] Place | [ ] City | __/6 |
|-------------|---------|----------|----------|--------|-----------|---------|

© Z.Nasreddine MD Version 7.1 www.mocatest.org Normal ≥ 26 / 30 TOTAL __/30

Administered by: ___________________________ > 23? Add 1 point if ≤ 12 yr edu
MoCA is more sensitive than MMSE

118 older adults; mean age 79; educ 14 years

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Sensitivity (95% CI)</th>
<th>Specificity (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMSE (≤ 24)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCI</td>
<td>0.17 (0.05-0.37)</td>
<td>0.96 (0.87-0.99)</td>
</tr>
<tr>
<td>MCI/AD</td>
<td>0.36 (0.22-0.52)</td>
<td>0.96 (0.87-0.99)</td>
</tr>
<tr>
<td>MoCA (≤ 26)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCI</td>
<td>1.00 (0.87-1.00)</td>
<td>0.35 (0.24-0.47)</td>
</tr>
<tr>
<td>MCI/AD</td>
<td>0.97 (0.87-0.99)</td>
<td>0.35 (0.24-0.47)</td>
</tr>
<tr>
<td>MoCA (≤ 23)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCI</td>
<td>0.96 (0.79-0.99)</td>
<td>0.95 (0.87-0.99)</td>
</tr>
</tbody>
</table>

Luis, et al Int J Geriatric Psych 2009
Questions remain…

- What do the MoCA scores mean?
  - What is really normal for a given age, education, and race?
- What is the best “cut-off” for screening for impairment?
• Using the Systolic blood PRessure INtervention Trial (SPRINT)

• To present normative data and cut-points for identifying impaired individuals in a large, diverse sample of older adults

• 8724 participants age 50+ with HTN, but no DM, stroke, dementia, or significant depression
  • Mean age 68 (9.4) yrs
  • 36% female
  • 59% White, 30% Black, and 11% Hispanic
  • 75% had >12 years of education
Cognitive Performance

- Mean (SD) MoCA = 23 (4.1)
- 15% were considered possibly impaired by Logical Memory or Digit Symbol Coding
- 70% had “positive screen” (<26) on MoCA
- 81% of Blacks and Hispanics scored <26
MoCA Norms for 12 yrs Education
90th, 50th, 10th percentile

Scores are ~ 3 points lower for minorities

ROC Curve for Impaired based on Screening battery*

Best Cut-off = 23
Sensitivity 71%
Specificity 68%

* Suspected impairment defined as participants with scores >1.5 SD below normative mean on either the Logical Memory Delayed Recall or the Digit Symbol Coding test, or baseline use of Alzheimer’s medications

MoCA scores are about 6 points lower than MMSE scores

Roalf, et al, Alzheimer's and Dementia 2012
<table>
<thead>
<tr>
<th>MoCA</th>
<th>MMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>28-30</td>
<td>30</td>
</tr>
<tr>
<td>20-21</td>
<td>26</td>
</tr>
<tr>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

Roalf et al. Alz & Dementia. 2012
Conclusions/Recommendations about MoCA vs MMSE

- If you want a screening test that is sensitive for MCI, MoCA definitely better than MMSE
  - Optimal cut-off still to be determined
  - MoCA highly sensitive to age/education/race effects
- If you want to track change over time in relatively high functioning cohort/population, MoCA probably better than MMSE
  - If you have a more impaired population, MMSE easier (faster) to administer and has less of a floor effect
- To screen out cognitively impaired participants from trials/studies, either is fine; adjust the cut-off as needed (cost may be a factor)
Measuring Cognition

• Global cognitive function
  • Mini-cog
  • MMSE, 3MSE, MoCA

• Domain specific cognitive functions
  • Memory
  • Executive function
  • Language
  • Processing speed
  • Concentration and working memory
  • Visuospatial function
• Word lists
  • Rey Auditory Verbal Learning Test (RAVLT)
  • Hopkins Verbal Learning Test (HVLT)
  • California Verbal Learning Test (CVLT)
• Paragraph Recall
  • Logical Memory Story
• East Boston Memory Test
Executive Function

- Multidimensional higher order processing
- Cognitive flexibility (set shifting)
- Planning/organizing
- Selective attention
Trails part B
Language Function

- Reading, writing, repetition, naming
- Boston Naming Test: 15-60 items
Concentration and Working Memory

- Digit Span forward and backward
- Digit Symbol Coding aka Digit Symbol Substitution Test (DSST)
Visuospatial Function and Memory: Rey-Osterrieth Figure
Summary

• Cognitive impairment and frailty are associated
  • More work is needed to better understand the relationships and potential underlying mechanisms

• Concept of “cognitive frailty” is emerging

• It is important to measure cognition, even if briefly, as relying on medical records or claims data will likely not be adequate for most studies
  • This can be done with global measures or domain specific measures depending on what is most appropriate for a given study