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Mild Cognitive Impairment: Definition and Diagnosis

Kim McCullough, PhD, CCC-SLP

Moderated by:
Amy Hansen, MA, CCC-SLP, Managing Editor, SpeechPathology.com

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- Must pass 10-question multiple-choice exam with a score of 80% or higher
  - Within 7 days for live webinar; within 30 days of registration for recorded/text/podcast formats
- Two opportunities to pass the exam
Learning Outcomes:

Participants will be able to:

1) Explain the diagnostic criteria and risk factors for MCI.

2) Describe the research indicating that subtle language impairment is a significant early marker of Alzheimer’s disease.

3) List tasks useful for assessing early changes in cognitive-communicative function.

Quick Facts: Alzheimer’s Disease (AD)

- Every **65 SECONDS** someone in the US develops the disease.
- Between 2000 and 2015 deaths from heart disease have decreased 11% while deaths from AD have increased 123%.
- In 2018, AD and other dementias will cost the nation $277 billion by 2050, these costs could rise as high as $1.1 trillion.
- Early and accurate diagnosis could save up to $7.9 trillion in medical and care costs.

https://www.alz.org/facts/
MCI Defined
Transitional zone between normal cognition and dementia.

More people with MCI than those without it develop Alzheimer's Disease.

About 8 of every 10 people who have amnestic MCI go on to develop Alzheimer's disease within 7 years. (Petersen, 2016; NIA, 2017)

Risk Factors
- Age
- APOE carrier status
- High alcohol consumption
- Lack of exercise
- Diabetes
- Hearing Loss
- Hypertension
- Depression
- Increased cholesterol
- Stress
- Sleep Issues
Protective Factors

• Youth
• Absence of APOE 4 variant
• Cognitively Engaging Activities
• Lifetime of exercise
• Nonsmoking
• Controlled cardiovascular risks
• Social stimulation
• Education

NIH-ADRDA Criteria for MCI-AD

(McKhann et al 2011)

• Concern regarding change in cognition compared to prior level.
• Impairment in one or more cognitive domains.
• Preservation of independence in functional abilities.
• Not demented.
• Criteria involving biomarkers are still in the research phase.
DSM-5 Criteria for Mild NCD (2013)

- Evidence of modest cognitive decline from a previous level of performance in one or more cognitive domains based on:
  - Concern regarding change in cognition compared to prior level.
  - A modest impairment in cognitive performance (documented by standardized neuropsychological testing).

- Cognitive deficits do not interfere with capacity for independence in everyday activities.

Cognitive Impairment Continuum

Typical Aging Brain

Subjective Cognitive Decline (SCD)

MCI (MILD NCD)

Mild Cognitive Impairment

Vascular Dementia

Alzheimer’s Disease

Other Dementias

Stable or Reversible

Early
Middle
Late

Amnestic: S/MD
Non-Amnestic: S/MD

Stable or Reversible

Dementia

Normal Cognition/PreClinical

Transitional Zone
Recent Biomarker Findings.....

- aMCI cases show the most pathologic biomarker burden
- nMCI and SCD subjects show similar levels of pathological biomarkers (elevated CSF tau and thinner ERC relative to controls)
- SCD represents a risk group


Rate of Conversion to Dementia

- Unclear
- Higher rates in those whose performance is 1.5 SD below mean
- Higher rate in older individuals
- Amnestic MCI more likely to convert
- Multi-domain more likely to convert than single domain
- Some question the existence of single domain MCI
Predictors of Reversion from MCI to Normal Cognition

- 1200 participants with MCI followed over 2 years.
- Variables associated with MCI reversion:
  - younger age
  - absence of APOE
  - lower Clinical Dementia Rating (CDR) score,
  - higher memory/language test scores.

- At 2 years,
  - 175 (14%) reverted to normal cognition,
  - 612 (51%) remained MCI, and lower CDR score
  - 421 (35%) progressed to dementia

Prevalence Estimates

- Long-term studies suggest that 15 to 20 percent of those aged 65 and older may have MCI.

(Sasaki et al., 2009; Snitz et al., 2009; Petersen et al., 2010; Roberts, R. and Knopman, D.S. 2013; Vos et al., 2015)
LANGUAGE IMPAIRMENTS:

- Language = Cognition in Action

Bayles, McCullough, & Tomoeda, 2018

What is called a “language impairment” also reflects one or more cognitive deficits.

Cognitive-Linguistic Impairment
Form of Cognitive-Linguistic Impairment in MCI?

- Little evidence of deficits in language knowledge.
- Abundant evidence of language performance deficits.

Cognitive-Linguistic Language Deficits

- **Discourse Processing**
  - Chapman et al 2002
  - Harris 2008
  - Fleming & Harris 2008

- **Oral Spelling**
  - Tsantali et al., 2013

- **Verbal Learning**
  - Jefferson et al 2008

- **Confrontation Naming**
  - Dwolatzky et al 2003
  - Grundman et al 2004
  - Petersen et al., 2004
  - Fraser et al., 2014
### Other Cognitive-Linguistic Deficits

<table>
<thead>
<tr>
<th>Verbal Fluency</th>
<th>Vocab. Diversity/Info</th>
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</thead>
<tbody>
<tr>
<td>Cooper et al 2004</td>
<td>Garrod et al 2005</td>
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<tr>
<td>Acki et al 2005</td>
<td>Harris et al 2008</td>
</tr>
<tr>
<td>Standish et al 2007</td>
<td>Johnson et al., 2018</td>
</tr>
<tr>
<td>Nutter-Lysham 2008</td>
<td>Mueller et al., 2018</td>
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<tr>
<td>Cottingham and Hawkins 2010</td>
<td></td>
</tr>
<tr>
<td>Tsantali et al 2013</td>
<td></td>
</tr>
<tr>
<td>Mueller et al., 2015; 2016</td>
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</tbody>
</table>

### Cognitive-Linguistic Deficits cont’d

<table>
<thead>
<tr>
<th>Repetition</th>
<th>Comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taler &amp; Phillips, 2008</td>
<td>Tsantali et al., 2013</td>
</tr>
<tr>
<td>McCullough &amp; Bayles, 2017</td>
<td>Johnson &amp; Lin, 2014</td>
</tr>
</tbody>
</table>
Summary: Cognitive-Linguistic Deficits

- Idea density
- Grammatical complexity
- Verbal fluency
- Vocabulary diversity
- Discourse processing
- Verbal Learning
- Confrontation Naming
- Oral Spelling
- Repetition
- Defining
- Comprehension

Sensitivity of Language scores ...

- For detecting MCI (Oulahaj et al, 2009)
  - Followed 241 Individuals for up to 20 years to id early markers of later MCI
  - Gave CAMCOG – large neuropsych battery
- Results: Subscores for language expression and learning/memory predicted time to conversion to MCI
Testing for MCI: Use a Broad-Based Assessment

- No gold standard for which test battery to use.
- Look for **pattern** of performance across tests
- Include tasks that have a **gradient of difficulty**
- Using of a combination of neuropsychological measures is likely to be the best approach to identifying those who may progress.
- Particularly when they combined memory with executive function or language tests. 
  Belleville et al., 2017

Testing for MCI: Use an Assessment that has Normative Data

- Use a test battery that has “comparison” normative data
  - Healthy Older Adult Performance v. MCI v. AD
Here’s what we did: Preliminary Data

- 83 participants who self-identified as at risk for MCI (aka mild NCD)
- Administered the Arizona Battery for Cognitive-Communication Disorders -2 (ABCD-2)

McCullough, Bayles, & Bouldin (2019, under review)

We hypothesized

1. that the majority of at risk individuals would score 1 standard deviation (SD) or more below the mean of (HOA) on at least one ABCD test,
2. that language performance tests would be those most sensitive to change because of the verbal memory demands required for successful completion.

ABCD-2: Overview

- Has “comparison data”
- All memory and language tasks supported in the literature are included
- 14 subtests divided into 5 Main Domains
  - Mental Status
  - Episodic Memory
  - Linguistic Expression
  - Linguistic Comprehension
  - Visuospatial Construction
### ABCD-2 Domains

<table>
<thead>
<tr>
<th>Linguistic Expression</th>
<th>Linguistic Comprehension</th>
<th>Verbal Episodic Memory and Learning</th>
<th>Mental Status</th>
<th>Visuospatial Construction</th>
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</thead>
<tbody>
<tr>
<td>*Object Description</td>
<td>*Following Commands</td>
<td>*Story Retelling: Immediate</td>
<td>Mental Status</td>
<td>*Generative Drawing</td>
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<tr>
<td>*Generative Naming</td>
<td>*Comparative Questions</td>
<td>*Story Retelling: Delayed</td>
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<td>*Figure Copying</td>
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<td>*Confrontation Naming</td>
<td>**Repetition</td>
<td>*Word Learning: Free Recall, Cued</td>
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<td>Recall, Recognition</td>
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<td>**Concept Definitions</td>
<td>Word Reading</td>
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<td>Comprehension &amp;</td>
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<td></td>
<td>Sentence Comprehension</td>
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*denotes cognitive domains specified by the DSM-5

**Complex Attention Task

** Executive Functions

** Working Memory

Social Cognition not assessed.

### Cognitive Impairment Continuum

![Diagram showing the cognitive impairment continuum with stages from SCD to “Early” MCI, “Middle” MCI, “Late” MCI, and Dementia.]
Language Comprehension Task: Repetition

Crawling summer trombone (6 syllables) vs. Loud ambassadors freeze stable waves (9 syllables)

<table>
<thead>
<tr>
<th>ABCD Subtest</th>
<th>HOA</th>
<th>MCI</th>
<th>MILD AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repetition</td>
<td>67.9</td>
<td>62.0</td>
<td>59.2</td>
</tr>
</tbody>
</table>
Language Comprehension Task: Following Commands

Clap, then point vs. Cough, smile, then whistle

<table>
<thead>
<tr>
<th>ABCD Subtest</th>
<th>HOA</th>
<th>MCI</th>
<th>MILD AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Following Commands</td>
<td>8.8</td>
<td>8.6</td>
<td>8.3</td>
</tr>
</tbody>
</table>

Testing for MCI: Know the Criteria (McKann et al 2011; DSM-V 2013)

- Self-report of change
- Performance below 1-1.5 SD below the mean
- Cognitive Processes include:
  - executive functions
  - attention
  - language
  - memory
  - visuospatial skills
- No dementia (usually 2+ SD below the mean)
- Able to perform activities of daily living
So, What’s our Role?

#1 Early Detection
Provides individuals with options that may help sustain brain function:
- Pharmacologic Interventions
- Life-style changes
- Behavioral interventions

#2 Provide Cognitive-Linguistic Intervention

Stay tuned for the upcoming intervention presentation (10-25-18)!

MCI represents…

- A critical point for controlling cognitive decline
  - Johnson & Lin, 2014

Stay tuned for the upcoming intervention presentation (10-25-18)!