Story Reading Speed, Recognition, and Comprehension in Aging and Dementia

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Purpose of this Study

The purpose of this study was to compare the performance of healthy older adults (HOA) and persons with dementia (PWD) on the following measures:

- Time taken to read a short story
- Comprehension of content read, and
- Ability to generate a title for a short story
Importance of studying reading ability in aging and dementia

- Reading is a foundational cognitive-linguistic skill; the need to read and comprehend what is read is pervasive in our daily lives.

- Reading is dependent on multiple cognitive abilities known to be affected by dementia (e.g., attention, working memory, semantic memory, language comprehension).

- Contradictory results have been reported about reading abilities in PWD and it is unclear whether reading is preserved in dementia or not (Bourgeois, 2001).

- Large number of studies on reading in PWD focus on single-word or single-sentence reading; very few studies on reading of narratives.
Research Questions

While silently reading a short story:

**Question 1:** Do PWD and HOA differ in the time taken to read a short story?

**Question 2:** Do PWD and HOA differ in their comprehension of a short story, as measured by performance on answering multiple choice questions?

**Question 3:** Do PWD and HOA differ in their ability to generate a title for a short story?
Method

- Informed consent was obtained from participants or caregivers.
- Medical history obtained; medical records/charts reviewed.
- Participants were administered:
  - **Mini-Mental State Exam** (Folstein, Folstein, & McHugh, 1975)
  - **Geriatric Depression Scale-Short Form** (Sheikh & Yesavage, 1986)
  - **Vision screening** (Adapted from the Arizona Battery for Communication Disorders of Dementia - Bayles & Tomoeda, 1993): Screening for literacy, visual scanning, and visual agnosia.
  - **Hearing screening**: Otoscopy, pure tone audiometric screening at frequencies from 500 Hz to 6000 Hz, and face-to-face word recognition testing.
# Study Participants

<table>
<thead>
<tr>
<th></th>
<th>HOA</th>
<th>PWD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample</strong></td>
<td>33 (6 M, 27 F)</td>
<td>33 (11 M, 22 F)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>Mean: 80.3</td>
<td>Mean: 84.8</td>
</tr>
<tr>
<td></td>
<td>Range: 64-95</td>
<td>Range: 70-96</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td>Caucasian: 28</td>
<td>Caucasian: 31</td>
</tr>
<tr>
<td></td>
<td>African-American: 3</td>
<td>African American: 1</td>
</tr>
<tr>
<td></td>
<td>Latino = 1</td>
<td>Biracial: 1 (Hispanic/Caucasian)</td>
</tr>
<tr>
<td></td>
<td>Asian = 1</td>
<td></td>
</tr>
<tr>
<td><strong>Years of Education</strong></td>
<td>Mean: 13.8</td>
<td>Mean: 12.5</td>
</tr>
<tr>
<td></td>
<td>Range: 12-18</td>
<td>Range: 8-18</td>
</tr>
<tr>
<td><strong>MMSE scores (30)</strong></td>
<td>Mean: 28.2</td>
<td>Mean: 20.7</td>
</tr>
<tr>
<td></td>
<td>Range: 26-30</td>
<td>Range: 11-29</td>
</tr>
<tr>
<td><strong>GDS-SF Scores (15)</strong></td>
<td>Mean: 2.5</td>
<td>Mean: 2.6</td>
</tr>
<tr>
<td></td>
<td>Range: 0-11</td>
<td>Range: 0-8</td>
</tr>
<tr>
<td><strong>MMSE - silent reading comprehension item</strong></td>
<td>Pass: 33, Fail: 0</td>
<td>Pass: 32, Fail: 1</td>
</tr>
</tbody>
</table>
# Participants with Dementia: Type and Severity of Dementia

<table>
<thead>
<tr>
<th>CLASSIFICATION (Severity and Dementia Type)</th>
<th></th>
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<tbody>
<tr>
<td><strong>Severity of Dementia</strong></td>
<td></td>
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</tbody>
</table>
| (Based on MMSE and Global Det. Scale)      | Mild: 27  
|                                           | Moderate: 6 |
| **Hachinski Scores**                       |  |
|                                           | Score $< 4$: 26  
|                                           | Score $> 7$: 7  |
| **Number of residents with specific type of Dementia** |  |
|                                           | Probable AD: 22  
|                                           | Dementia NOS = 4  
|                                           | Vascular Dementia: 7  |
Task Instructions

BEFORE BEING ASKED TO READ THE STORY

“I am going to give you a short story to read. I want you to read it one time silently to yourself. I will tell you when to start. As soon as you are done reading the story, please say -- I’m done.”

AFTER READING THE STORY: Title generation

“I would like you to come up with a title for the story that you just read.”

AFTER GENERATING THE TITLE: Reading Comprehension

“Now I am going to ask you some questions about the story that you just read. I will read out the questions while you follow along. Then you will review the four choices for each question and pick the best answer.”
Reading Measures

- **Story Reading Speed**
  Number of seconds taken to silently read a 106-word story from the *Gray Oral Reading Test-4th Edition* (Wiederholt & Bryant, 2001).

- **Story Comprehension**
  Number of multiple choice questions about the story, correctly answered (targeting verbatim recall or inferential processing).

- **Story Title Generation**
  Type of story title generated by participants.
The Blue Jay Story (GORT-IV)

Story presented in 24-point, black font, on white paper to maximize visual contrast
Results: Reading Speed

Between group differences in reading speed were analyzed statistically using the nonparametric Wilcoxon 2-sample t-test.

There were significant between-group differences in reading speed ($p = 0.0038$) with PWD taking longer to read a story than HOA.

![Reading Speed Chart]

<table>
<thead>
<tr>
<th></th>
<th>PWD</th>
<th>HOA</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>44.09</td>
<td>29.25</td>
</tr>
<tr>
<td>SD</td>
<td>23.04</td>
<td>14.10</td>
</tr>
</tbody>
</table>

$M =$ mean, $SD =$ standard deviation.
Results: Reading Comprehension

Between group differences were analyzed statistically using the nonparametric Wilcoxon 2-sample t-test.

There were significant between-group differences in reading comprehension with \( p = 0.0006 \) with PWD having poorer comprehension than HOA.

<table>
<thead>
<tr>
<th>Score</th>
<th>HOA</th>
<th>PWD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score of 4-5</td>
<td>26</td>
<td>14</td>
</tr>
<tr>
<td>Score of 2-3</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Score &lt; 2</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

Reading Comprehension Score (out of 5)

- PWD: \( M = 4.12 \), SD = 0.89
- HOA: \( M = 3 \), SD = 1.27
<table>
<thead>
<tr>
<th>Numerical score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No response (e.g., <em>I don’t know</em>).</td>
</tr>
<tr>
<td>1</td>
<td>Incomplete or reference to a minor inferential/literal detail. E.g. <em>Things Happen</em></td>
</tr>
<tr>
<td>2</td>
<td>Title containing only literal OR only inferential information. E.g. <em>The Blue Jay, Solving a Puzzle</em></td>
</tr>
<tr>
<td>3</td>
<td>Title containing both literal AND inferential information. E.g. <em>The Clever Blue Jay</em></td>
</tr>
</tbody>
</table>
Results – Title Generation

Sample HOA titles
- The Bird And Her Water
- The Thirsty Blue Jay
- Blue Jay With an Innovative Mind
- How The Blue Jay Got Its Water
- A Blue Jay Trying To Get A Drink
- Solving a Puzzle
- There Is Always Hope
- Never Give Up Hope
- Use Your Brains
- If At First You Don’t Succeed, Try Again

Sample PWD Titles
- The Thirsty Jay
- The Blue Jay
- The Hope Of The Jay
- Adventures of Jay
- The Bright Jay Bird
- The Bird Is Trying to Find something to drink
- Resourceful
- Life stories
- Worried
Results: Title Generation

- More *No Responses* in PWD (n = 4); none in HOA.

- More vague or incomplete titles (e.g. *Resourceful, Don’t give up the ship*) by PWD (n=3); none in HOA.

- More nonspecific titles (e.g. *The blue jay*) by PWD (n = 3); none in HOA.

- The majority of PWD, however, were able to provide a title (rated 2 or 3) demonstrating some degree of inferential comprehension and gist processing. This is a striking finding, given that PWD comprehension scores were markedly poorer than HOA.
Conclusions

- Study findings add to the literature on text reading speed and reading comprehension in healthy older adults and persons with dementia. Our key findings are that:

1. **Persons with dementia take more time to read a narrative, than HOA.**

2. **Reading comprehension of a short story in persons with mild to moderate dementia is notably poorer than HOA, despite PWD taking longer to read the short story, and provision of written multiple-choice answers.**

3. **The ability to generate a title for a story was somewhat preserved in the majority of our PWD sample, indicating some spared inferential comprehension and gist processing.**
Clinical Implications

- Importance of studying written language processing, and assessing it in persons with dementia.

- Testing reading ability is directly relevant to the use/design of written cues, low-tech AAC devices, and memory wallets and books.

- Significance of providing more time for written information processing by persons with dementia, and assessing comprehension via multiple indices.
Unanswered Questions

- How might length of a narrative influence reading speed and comprehension?

- How does the type of narrative (e.g., story vs. everyday text like letters, forms, documents) influence reading speed and comprehension?

- How do specific task instructions influence reading speed, comprehension, and title generation?
Future Directions

- Investigating the best predictor of reading comprehension in dementia – mental status, education level, memory deficit, or language deficit.

- Developing interventions for facilitating reading comprehension in HOA, persons with mild cognitive impairment, and dementia.
  - Montessori-based Interventions – *Question Asking Reading* (Camp and colleagues, 2001; Mahendra et al., 2006)
  - Book Club type Life Participation Interventions (e.g. Whitehouse and colleagues, 2009; Elman & Bernstein-Ellis, 2006)
Acknowledgments

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