Health Literacy in Older Adults With and Without Low Vision

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MeSH TERMS
• comprehension
• health literacy
• macular degeneration
• reading
• vision, low

OBJECTIVE. In this study, we investigated whether older adults with low vision (LV) from age-related macular degeneration (AMD) demonstrated lower functional health literacy than older adults without LV.

METHOD. Fifty adults with AMD were matched with adults without LV on age, gender, education, and income. We measured visual acuity, contrast sensitivity, and reading speed and administered the Test of Functional Health Literacy in Adults (TOFHLA) using two test time conditions, standard and unlimited, to measure health literacy levels.

RESULTS. The group with LV had considerably lower TOFHLA scores for both time conditions ($p < .001$) and took notably longer to complete the test ($p < .001$). Poorer acuity correlated with lower TOFHLA scores in the group with LV.

CONCLUSION. Older adults with LV may take longer to read and understand health information, which has important implications for providing health education to support self-management. Modifying components of the reading task may facilitate reading performance and understanding of health education materials.


Two-thirds of older adults live with chronic health conditions that limit participation in everyday activities (Vogeli et al., 2007). Chronic health conditions generally have no cure and are often medically complex. Patients learn to self-manage a condition by modifying lifestyle and health behaviors to minimize its effect on daily life (Richardson et al., 2014). Health care providers support patient self-management efforts through education and instruction (Richardson et al., 2014). Occupational therapy practitioners are increasingly providing interventions to improve the self-management skills of older adults with chronic conditions (Foster, Bedekar, & Tickle-Degnen, 2014; Richardson et al., 2014).

Successful self-management requires a knowledgeable patient who is able to understand and adhere to medical regimens and navigate the complex health care system to obtain services. Proficiency in functional health literacy is considered an important component of self-management (Rudd, 2007). Functional health literacy is the ability of a person to acquire health knowledge by locating and using information in documents, deciphering numbers, and completing calculations. Low functional health literacy levels are associated with poorer self-management and health status and increased hospitalization among older adults (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011).

As a skill dependent on reading, functional health literacy may be influenced by intrinsic variables (e.g., age, innate intelligence, primary language, cognitive decline) and extrinsic variables that reflect environmental influences (e.g., educational attainment, profession, socioeconomic status, culture; Martin et al., 2009). A person must also have sufficient vision to accurately decipher print on instructions, labels, and devices. Thus, *low vision* (LV), a permanent level of
vision loss sufficient to limit completion of daily activities, may also affect functional health literacy.

LV is a common chronic condition in older adults; age-related macular degeneration (AMD) is the most prevalent cause of LV among older Americans (Eye Diseases Prevalence Research Group, 2004). People with AMD often experience impaired reading performance, including lower reading speed and accuracy, but not necessarily reduced comprehension (Legge, 2007). Although many older adults with AMD and other age-related eye diseases can read documents using magnifiers, researchers of health literacy studies have systematically excluded participants with LV (Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohman, & Rudd, 2005). Consequently, little is known about health literacy levels of older adults with visual impairment, even though nearly one-third of these adults live alone without in-home or family support (Sloan, Ostermann, Brown, & Lee, 2005) and are often responsible for self-managing their chronic conditions.

In this study, we investigated whether community-dwelling older adults with LV resulting from AMD demonstrated lower functional health literacy levels than older adults without LV using the Test of Functional Health Literacy in Adults (TOFHLA; Nurss, Parker, & Baker, 1995). We further examined associations in the group with LV among TOFHLA scores and variables including visual acuity, contrast sensitivity, and reading speed.

Method
The university’s institutional review board approved the study; participants provided written informed consent. Inclusion criteria for all participants included (1) minimum age of 65 yr, (2) community dwelling, (3) high school diploma or equivalence, (4) English speaking, (5) no medical condition that might affect cognition or reading, (6) no major uncorrected hearing loss, (7) self-report of reading at least 20 min daily, (8) minimal risk for cognitive impairment defined as less than four errors on the Short Portable Mental Status Questionnaire (Pfeiffer, 1975), and (9) minimal risk for depression defined as less than five errors on the Geriatric Depression Scale–Short Form (Yesavage & Sheikh, 1986). Participants with LV were required to have a documented AMD diagnosis without another major eye disease or condition that would affect reading and a distance visual acuity between 20/60 and 20/400 in the better eye. Participants without LV were required to have 20/30 or better habitual distance acuity and no known eye disease. Visual acuity was measured with the Early Treatment Diabetic Retinopathy Study (ETDRS; Ferris, Kasoff, Bresnick, & Bailey, 1982) acuity chart while participants were wearing their habitual correction.

Participants
One hundred two participants were recruited; 2 people were ineligible, resulting in 50 adults with LV and 50 adults without LV. Participants with LV were recruited from the University of Alabama at Birmingham Center for Low Vision Rehabilitation. We recruited participants without LV from the same metropolitan area using flyers and referrals to obtain a sample closely matching the group with LV on age, gender, education, and income.

Instruments
The first author (Warren) administered five assessments to the participants during one 60- to 90-min session in a private, distraction-free environment, typically in the participant’s home. Rest breaks were offered between and during assessments to minimize fatigue. Participants in both groups used rest breaks, but the number of breaks provided was not recorded.

The 12-point-font, long version of the TOFHLA was chosen to measure the functional health literacy of the participants because it has been used extensively in research on functional health literacy in older adults (Mancuso, 2009). The TOFHLA uses real-life examples to measure comprehension of printed health information. The test has two sections: numeracy and reading comprehension. Summed section scores produce a composite score ranging from 0 to 100 points. The point score categorizes the health literacy level as inadequate (0–59), marginal (60–74), and adequate (75–100). The 17-item numeracy test is administered first and given orally with props such as prescription medicine bottles. It is used to assess understanding of dosage, timing, and expiration of medications; medical test results; scheduling of medical appointments; and eligibility for financial aid. Responses are scored according to specific guidelines. The raw score (0–17 points) is converted to a weighted score ranging from 0 to 50.

The reading comprehension section has three short passages written at sequentially higher reading grade levels: preparation instructions for an X-ray (4.3 grade reading level), a Medicaid document excerpt (10.4 grade reading level), and a surgical consent (19.5 grade reading level). The passages are read silently. Each sentence has 1 word missing; the participant selects the best word from a choice of 4 words. The section has 50 missing words to produce a raw score between 0 and 50 points.

Standard administration time is 10 min for numeracy and 12 min for reading comprehension; unanswered
questions are scored as errors. Scoring unanswered questions as errors meant that participants with LV might score lower because of a slower reading speed. To capture the effect of slow reading, we modified the timing procedure so that participants were allowed to complete each section. Two scores were recorded: the standard time score—recorded for the last test item completed when the specified time limit elapsed—and an unlimited time score—recorded when all items were answered. Two completion times were also recorded: time required to complete the section under the standard timing condition (standard time) and time required to complete all test items (unlimited time). Rest breaks were not included in the recorded time; the examiner stopped the timer and resumed timing after the break.

The MNREAD Acuity Chart (Regents of the University of Minnesota, 1994) was used to determine maximum reading speed. The chart simulates a real-world reading experience and has been used extensively in LV reading research (Legge, 2007). The chart contains 19 sentences composed of 10 standard-length common third-grade words. The sentences descend in order from 1.3 logMar (20/400 Snellen acuity at 40 cm) to 0.13 logMar (20/6 Snellen acuity at 40 cm). The sentences are read aloud and timed. Participants wore their habitual reading correction and held the test chart at their preferred distance. Participants with LV used their personal magnifier if needed; all participants were offered use of a 50-watt halogen reading lamp to complete the test. Maximum reading speed was calculated as the mean of the three fastest recorded reading speeds following procedures described by Patel, Chen, Da Cruz, Rubin, and Tufail (2011) and was converted into words per minute with a standardized conversion chart.

The Mars Letter Contrast Sensitivity Test (Arditi, 2005) is a clinical test that measures peak contrast sensitivity between 100% and 1% contrast. The test has 48 letters, each with a value of 0.04 log contrast sensitivity, arranged in rows. The total contrast sensitivity score represents the value of the last correctly identified letter minus 0.04 for each incorrectly read letter before the last two consecutive errors. Participant contrast sensitivity scores were categorized as normal, moderate, severe, or profoundly impaired on the basis of norms established for people age >60 yr.

The Leisure Activity Score Questionnaire (Bull, 1982) is an orally administered structured self-report questionnaire that identifies older adult participation in leisure activities. The person rates participation in 12 common leisure activities (e.g., TV and radio, card games, reading, rides and walks, crafts, gardening, theater and movies, church activities, volunteer work, singing and playing musical instruments) and 4 leisure activities of the person’s choosing. The test yields a score between 0 and 16 points to provide an index of activity involvement.

Statistical Analyses

Statistical analyses were completed with IBM SPSS Statistics (Version 19; IBM Corporation, Armonk, NY). Chi-square analyses and t tests were conducted to test equivalency between groups on variables associated with reading performance. The t tests were conducted to test the differences between groups on TOFHLA scores for the two timing conditions. A Wilcoxon signed-rank test was used to test differences in health literacy levels. Pearson correlations were calculated to test associations among vision-related variables and TOFHLA scores for the two timing conditions in the group with LV. A (two-tailed) significance level of .05 was used.

Results

Participants were age 65–94 yr, with an average age of 81 yr (standard deviation [SD] = 5.87); all but 2 participants were White. The two groups were equivalent in age; gender; marital status; living arrangement; income; education; occupation; years in retirement; and number of comorbidities, prescribed medications, and leisure activities (Table 1). Most participants lived in their own homes, had some college or a college degree, had worked in skilled or professional occupations, and reported an average income greater than $40,000 per year. They regularly participated in an average of nine leisure activities (SD = 2.4), reported an average of three comorbidities (SD = 1.2), and took an average of seven prescribed medications (SD = 3.5). All participants demonstrated minimal risk for cognitive impairment or depression per inclusion criteria.

The groups differed considerably on vision and reading-related variables. Compared with the group without LV, participants with LV had poorer acuity, t(49) = 21.9, p ≤ .001; poorer contrast sensitivity function, t(49) = 15.3, p ≤ .001; and lower reading speeds, t(49) = 7.75, p ≤ .001. Two-thirds of the participants with LV (n = 33) used an optical device to read test materials, and 30% (n = 15) of the participants with LV used extra task lighting; the participants without LV relied on typical lighting.

Table 2 shows the difference in TOFHLA scores between the groups. The group with LV had considerably lower composite scores and reading comprehension scores than the group without LV under both timing conditions. Participants with LV scored an average of 15 points
lower on the composite test under the standard time condition. The mean difference in scores between the groups was reduced to only about 3 points with unlimited time but remained statistically significant, \(t(99) = 2.89, p = .005\). Participants with LV had considerably lower scores on the reading comprehension section for both timing conditions, but scores for the numeracy section were considerably lower only on the standard timing condition. Lower acuity and lower reading speed were associated with lower test scores. In the unlimited time condition, only acuity remained significantly correlated with test scores \((r = .45, p = .01)\), showing that poorer acuity was associated with lower test scores.

### Discussion

In this study, we provided an initial exploration of the relationship between LV and functional health literacy by investigating whether community-dwelling older adults with AMD demonstrated lower functional health literacy than older adults without LV. Participants with LV were more impaired on all vision-related variables and had considerably slower reading speeds than the adults without LV. The influence of slow reading speed on test performance was apparent in the considerable improvement in scores when participants with LV were given unlimited time to complete the TOFHLA. This finding suggests that the participants with LV might have differed from the participants without LV not in ability to comprehend health materials but rather in the amount of time required to achieve an adequate comprehension level.

According to Legge (2007), older adults with LV may experience greater difficulty comprehending print materials because they are forced to allocate more attention to decoding difficult-to-see words, straining attentional reserves already diminished by aging. To compensate, readers with LV might deliberately slow reading speed to reduce the demands on attention and improve comprehension (Legge, 2007). However, even with unlimited time to complete the test, there was a statistically significant mean difference of 3.4 points in scores between the groups. The correlation between visual acuity and TOFHLA scores for the unlimited time condition suggests that poorer acuity may have contributed to the lower scores in the group with LV.

The paragraph format of the TOFHLA reading comprehension section may also have contributed to more errors...
in the group with LV. According to Legge (2007), paragraph-style formats require more attention from readers with LV, which may increase fatigue. Although all participants were offered and took rest breaks, it is possible that participants with LV experienced greater fatigue, causing them to commit more errors on the reading comprehension section.

Study Limitations and Future Research

Studying only people with AMD limited generalization of the findings to the greater population with LV. Future researchers should include other age-related eye diseases to obtain a more representative description of the effect of LV on functional health literacy levels. On the basis of the study findings, one can also question the efficacy of using timed tests such as the TOFHLA to measure health literacy in adults with LV; future researchers should explore test designs that accommodate readers with LV.

Implications for Occupational Therapy Practice

A consistent complaint voiced by people with LV is the heavy reliance by health care providers on using visually inaccessible print materials to deliver health information, including instructions on medications and medical regimens as well as appointments, referrals, and other paperwork required to receive services (Harrison, Mackert, & Watkins, 2010; Sharts-Hopko, Smelter, Ott, Zimmerman, & Duffin, 2010; Williams, 2002). Difficulty reading print can limit the person’s ability to participate fully in self-management of his or her health conditions; some people with LV believe that it suggests to health care providers a cognitive inability to manage their health, and thus they are excluded from patient–provider conversations (Sharts-Hopko et al., 2010). Of the LV participants in this study, 70% had been to college and read on a daily basis, but they still had lower TOFHLA scores than their peers without LV. However, when slow reading speed was accommodated for with unlimited test time, 98% of the participants with LV achieved adequate health literacy on the basis of TOFHLA scores.

The American Occupational Therapy Association (2011) published a societal statement on health literacy, committing occupational therapy practitioners to ensure “that all health-related information and education . . . match that person’s literacy abilities” (p. S78). Resources are readily available to assist occupational therapy practitioners to create accessible print materials for clients with LV. The American Printing House for the Blind

<p>| Table 2. Differences in TOFHLA Scores for Standard and Unlimited Time Conditions |
|-----------------------------------------------|-----------------|-----------------|-------|-------|--------|        |</p>
<table>
<thead>
<tr>
<th>TOFHLA Score</th>
<th>With Low Vision (n = 50), M (SD)</th>
<th>Without Low Vision (n = 50), M (SD)</th>
<th>t</th>
<th>p</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite</td>
<td>77.9 (16.3)</td>
<td>93.2 (7.2)</td>
<td>6.12a</td>
<td>&lt;.001</td>
<td>[10.3, 20.2]</td>
</tr>
<tr>
<td>Standard time</td>
<td>91.3 (6.5)</td>
<td>94.7 (5.2)</td>
<td>2.89</td>
<td>&lt;.005</td>
<td>[1.1, 5.8]</td>
</tr>
<tr>
<td>Unlimited time</td>
<td>32.9 (12.3)</td>
<td>46.4 (4.9)</td>
<td>7.19a</td>
<td>&lt;.001</td>
<td>[9.7, 17.2]</td>
</tr>
<tr>
<td>Reading comprehension</td>
<td>45.2 (4.0)</td>
<td>47.8 (2.8)</td>
<td>3.69a</td>
<td>&lt;.001</td>
<td>[1.2, 3.9]</td>
</tr>
<tr>
<td>Standard time</td>
<td>44.1 (8.0)</td>
<td>46.8 (3.9)</td>
<td>2.14a</td>
<td>.036</td>
<td>[0.2, 5.2]</td>
</tr>
<tr>
<td>Unlimited time</td>
<td>45.5 (6.0)</td>
<td>46.9 (3.8)</td>
<td>1.27</td>
<td>.207</td>
<td>[−0.7, 3.3]</td>
</tr>
<tr>
<td>Numeracy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unlimited time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. CI = confidence interval; M = mean; SD = standard deviation; TOFHLA = Test of Functional Health Literacy in Adults.

*Denotes Levene’s correction for unequal variances.

<p>| Table 3. Differences in TOFHLA Completion Time for Standard and Unlimited Time Conditions |
|-----------------------------------------------|-----------------|-----------------|-------|-------|--------|</p>
<table>
<thead>
<tr>
<th>TOFHLA Score</th>
<th>Low Vision (n = 50), M (SD)</th>
<th>Without Low Vision (n = 50), M (SD)</th>
<th>t</th>
<th>p</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite</td>
<td>19.1 (2.6)</td>
<td>15.0 (3.4)</td>
<td>6.78a</td>
<td>&lt;.001</td>
<td>[2.6, 5.3]</td>
</tr>
<tr>
<td>Standard time</td>
<td>26.8 (10.4)</td>
<td>15.7 (4.7)</td>
<td>6.89a</td>
<td>&lt;.001</td>
<td>[7.9, 14.4]</td>
</tr>
<tr>
<td>Unlimited time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading comprehension</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Standard time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unlimited time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numeracy</td>
<td>11.5 (1.3)</td>
<td>9.2 (4.9)</td>
<td>6.03a</td>
<td>&lt;.001</td>
<td>[1.5, 3.0]</td>
</tr>
<tr>
<td>Standard time</td>
<td>18.5 (7.9)</td>
<td>9.9 (3.6)</td>
<td>7.02a</td>
<td>&lt;.001</td>
<td>[6.2, 11.2]</td>
</tr>
<tr>
<td>Unlimited time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numeracy</td>
<td>7.5 (1.7)</td>
<td>5.7 (1.5)</td>
<td>4.59</td>
<td>&lt;.001</td>
<td>[1.1, 2.4]</td>
</tr>
<tr>
<td>Unlimited time</td>
<td>8.3 (3.5)</td>
<td>5.8 (1.5)</td>
<td>4.73a</td>
<td>&lt;.001</td>
<td>[1.5, 3.6]</td>
</tr>
</tbody>
</table>

Note. Test of Functional Health Literacy in Adults (TOFHLA) time is reported in minutes. CI = confidence interval; M = mean; SD = standard deviation.

*Denotes Levene’s correction for unequal variances.
If a client struggles with reading using these modifications, seek the expertise of a specialist in LV rehabilitation.

**Acknowledgment**

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**References**


