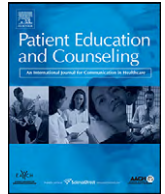




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Short Communication

Correlating reading comprehension and health numeracy among adults with low literacy

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ABSTRACT

Objective: Using the Test of Functional Health Literacy for Adults (TOFHLA), a pilot study was conducted to assess whether reading comprehension and numeracy scores sufficiently correlate in health contexts among adults with low literacy skills.

Methods: The TOFHLA was administered to 144 adults with low literacy enrolled in a health literacy program prior to the start of coursework. Raw scores for reading and numeracy were calculated. Weighted numeracy scores were calculated and compared to raw reading comprehension scores.

Results: Among 143 participants, 20% ($n = 28$) had a higher numeracy score than reading comprehension score, while an additional 20% scored lower in numeracy than in reading comprehension.

Conclusion: This study found that reading comprehension and numeracy skill in the context of understanding health information do not necessarily correlate for specific disadvantaged groups. This finding calls attention to the need to further examine numeracy as a construct which is conceptually separate from reading comprehension, and highlights the importance of including a numerate component in health literacy evaluations.

Practice implications: The results of this study have important implications for medical decision-makers, health educators, and health promoters working with traditional methods of assessing health literacy.

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1. Introduction

Inadequate health literacy and numeracy have been linked with poor health outcomes [1–3]. Certain populations are at greater risk, including those with low educational attainment [4,5]. While there is a growing recognition in the scholarly literature of the importance of health numeracy [1,6–8], numeracy constructs have been either absent from some common health literacy assessments or eliminated altogether to create a shorter assessment [9–11]. The investigators examined whether numeracy should be included as a separate construct in health literacy tools. A pilot study was conducted using the Test of Functional Health Literacy for Adults (TOFHLA) administered to a sample of adults with low literacy. The purpose was to assess whether reading comprehension and numeracy scores sufficiently correlate in health contexts among adults with low literacy that a

health literacy assessment should be constructed on reading comprehension alone. This correlation has important implications for medical decision-makers, health educators, and health promoters working with traditional methods of assessing health literacy.

Health literacy is defined as “the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions” ([12] (p. 11–20)). Low health literacy affects more than 90 million adults in the U.S. [13], and research has linked it with adverse health outcomes such as poor self-management of chronic diseases, less healthy behaviors, higher rates of hospitalizations, and overall poorer health [1–3]. Health literacy is influenced by several factors (e.g., reading and listening, cultural and conceptual knowledge) [14].

An important component of health literacy is health numeracy [6]. Health numeracy skills range from the ability to understand and follow dosage directions on a medicine bottle [15] at the lowest level, to the ability to understand and use typical risk reduction expressions [16] at the highest level. Patients with low health numeracy skills tend to have poorer health outcomes compared to those with higher skills [1].

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One of the most widely used reading assessment tools is the TOFHLA, which tests a patient’s ability to read passages and phrases and read and understand numbers using real materials from health care settings [17]. The tool consists of two parts: reading comprehension (50-items) and numeracy (17-items). While the reading comprehension section involves reading and interpreting text from health materials (e.g., hospital informed consent forms), the numeracy portion tests one’s ability to comprehend directions for taking medicines and monitoring blood glucose, for example [17].

2. Methods

This study examined the relationship between health literacy assessed by reading comprehension questions and health numeracy assessed by numeracy questions on the TOFHLA. The TOFHLA was administered to a convenience sample of 144 individuals enrolled in a health literacy course administered by the Georgia State Department of Technical & Adult Education, Office of Adult Literacy, but who had not begun the coursework. The objective was to evaluate if reading comprehension questions alone are sufficient to assess health literacy levels among adults with low literacy; or if both reading comprehension and numeracy questions should be included.

2.1. Population

Participants were identified as having “low literacy” based on how they performed on the Comprehensive Adult Student Assessment System (CASAS) [18], an educational assessment administered by adult education programs. All participants were <18 years old, English-speaking, had not completed high school, and were not enrolled in school at the time. Additional demographic information is unavailable. However, overall enrollment (N = 321) in the health literacy program was approximately 58% female, 43% White, 38% Black, 17% Hispanic, and 2% other racial/ethnic groups.

2.2. Sample and procedures

The assessment was administered one-on-one by six program instructors during Spring 2005, prior to the start of the health literacy course to ensure that instruction would not affect scores. Complete TOFHLA data were available for 143 students.

2.3. Data analysis

The TOFHLA includes a raw reading comprehension score, a raw numeracy score, and a weighted numeracy score. Raw scores range from 0 to 50 for reading comprehension and 0–17 for numeracy. The weighted numeracy score equals the raw numeracy score converted from a scale of 0–17 to a scale of 0–50 by summing the numeracy items and multiplying their total by 2.941. To reduce the possibility of error, weighted numeracy scores were recalculated by a researcher using a computer. The computed weighted numeracy score was used in the analysis. The raw reading comprehension and the weighted numeracy scores were added together to yield an overall score between 0 and 100.

An overall score between 0 and 59 is considered Inadequate Functional Health Literacy [19]. Typically, those scoring in this range are unable to read and/or interpret health texts. Individuals scoring between 60 and 74 are considered to have Marginal Functional Health Literacy, and generally have difficulty reading and interpreting health materials. Finally, individuals scoring between 75 and 100 can read and interpret most health texts and are considered to have Adequate Functional Health Literacy [19].

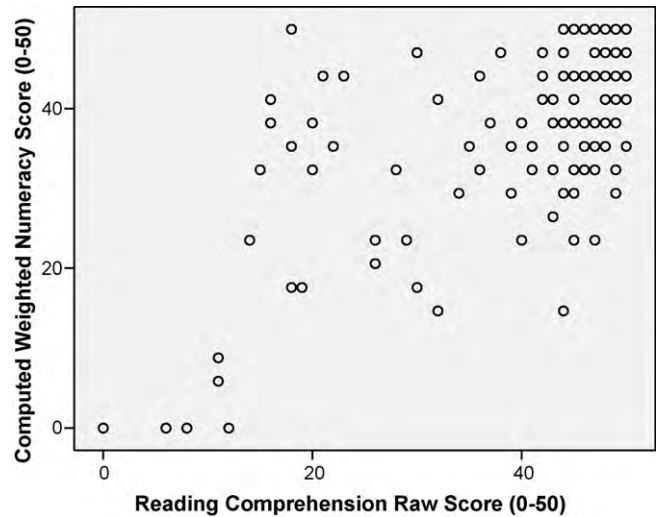


Fig. 1. Reading comprehensive scores and numeracy scores.

Table 1
 Reading comprehension categories and numeracy categories.

		Reading comprehension			Total
		Inadequate	Marginal	Adequate	
Numeracy	Inadequate	14	4	9	27
	Marginal	11	3	15	29
	Adequate	9	8	70	87
Total		34	15	94	143

In this study, the same relative range widths were used to categorize raw reading comprehension scores into inadequate (0–29), marginal (30–37), or adequate (38–50) reading comprehension. Weighted numeracy scores were similarly categorized into inadequate (0–29), marginal (30–37) and adequate (38–50) numeracy. The study data were analyzed by crosstabulation using SPSS version 11.5. Correlations between raw reading comprehension and computed weighted numeracy scores were assessed using Pearson’s correlation coefficient.

3. Results

A scatter plot of raw reading comprehension score versus weighted numeracy score is shown in Fig. 1. The correlation is 0.587, meaning that only about one-third (35%) of the variance of the numeracy score is shared with the reading comprehension score, with the remaining 65% of the variance unexplained.

A crosstabulation of the reading comprehension category (inadequate, marginal, and adequate) and the numeracy category (inadequate, marginal, and adequate) is shown in Table 1. Only 60% (87/143) of the study participants had either: (1) both adequate reading and adequate numeracy, (2) both marginal reading and marginal numeracy, or (3) both inadequate reading and inadequate numeracy. Twenty percent (20%) of the sample had higher numeracy than reading comprehension scores, while an additional 20% scored lower in numeracy than in reading comprehension.

4. Discussion and conclusion

4.1. Discussion

The results underline the importance of including numeracy questions within a health literacy assessment tool when working

with adults with low literacy. Two out of 10 adults with low literacy tested for reading comprehension only will have *more* problems with health literacy tasks, such as correctly taking prescription medicines that require strong numeracy competencies, than anticipated by the assessment score. Post-assessment efforts to help these individuals made within the context of general health care and educational settings may not adequately address numeracy understanding. Another two out of ten adults with low literacy who are tested on reading comprehension alone will have *less* problems than anticipated by the assessment. For these individuals, more attention than necessary may be given to their numeracy skills.

The results of this study more generally suggest that reading comprehension and numeracy skill in the context of understanding health information do not necessarily correlate, especially within specific disadvantaged groups. This calls attention to the need to further examine numeracy as conceptually separate from reading comprehension. Recognizing numeracy as an integral yet distinct part of health literacy highlights the importance of including a numerate component in such evaluations.

The primary limitations of this pilot study are the sample size and that the study drew from a convenience sample. As the sample was comprised of a specialized group of minorities (individuals with low educational attainment) identified with low literacy who self-selected into a health literacy program, the results may not be generalizable to non-similar groups. Because the test was not administered in Spanish, the results may also differ for individuals with limited English proficiency. It should be noted that while the sample consisted of individuals who did not graduate from high school, this attribute represents a significant proportion (23%) of the general population [20]. Participants' performance on the TOFHLA was comparable to that of many other adults both enrolled and not enrolled in ABE programs [13].

Additionally, because several administrators in the current study did not record participants' demographic information, important analyses of race/ethnicity, sex, and age are missing. Yet, demographic data is provided on the general body of students, and the study sample is likely to be similar.

4.2. Conclusion

This study found that reading comprehension and numeracy skills did not strongly correlate for 40% of the adults in this study with low literacy.

4.3. Practice implications

In addition to reading comprehension, numeracy is an important factor to consider when working with adults with low literacy. The findings present a number of implications for

health care clinicians and educators working with individuals with low literacy. Through an improved understanding of the vital role of numeracy in health literacy, practitioners will be better equipped to recognize and address the needs of patients with low health literacy. Initiatives should be developed to address health numeracy specifically (not just as a part of health literacy), especially among disadvantaged groups at risk for low literacy. Steps could be taken to identify populations with low numeracy for whom interventions would be appropriate [6].

References

- [1] Estrada C, Martin-Hyrmiewics M, Peek BT, Collins C, Byrd JC. Literacy and numeracy skills and anticoagulation control. *Am J Med Sci* 2004;328:88–93.
- [2] Baker DW, Gazmararian JA, Williams MV, Scott T, Parker RM, Green D, et al. Functional health literacy and the risk of hospital admission among Medicare managed care enrollees. *Am J Public Health* 2002;92:1278–83.
- [3] Houts PS, Lenhard RE, Varricchio C. Low literacy skills: an important barrier in healthcare. *Cancer Pract* 2000;8:2–3.
- [4] Kunter M, Greenberg E, Jin Y, Paulsen C. The health literacy of America's adults: results from the 2003 National Assessment of Adult Literacy (NCES 2006-483). Washington, DC: National Center for Education Statistics, U.S. Department of Education; 2006.
- [5] Paasche-Orlow MK, Parker RM, Gazmararian JA, Neilsen-Bohlman LT, Rudd RR. The prevalence of limited health literacy. *J Gen Intern Med* 2005;20:175–84.
- [6] Golbeck AL, Ahlers-Schmidt C, Paschal AM, Dismuke SE. A definition and operational framework for health numeracy. *Am J Prev Med* 2005;29:375–6.
- [7] Schwartz SR, McDowell J, Yueh B. Numeracy and the shortcomings of utility assessment in head and neck cancer patients. *Head Neck* 2004;26(May):401–7.
- [8] Woloshin S, Schwartz LM, Moncur M, Gabriel S, Tosteson AN. Assessing values for health: numeracy matters. *Med Decis Making* 2001;382–90.
- [9] Baker DW, Williams MV, Parker RM, Gazmararian JA, Nurss J. Development of a brief test to measure functional health literacy. *Patient Educ Couns* 1999;38:33–42.
- [10] Bass PF, Wilson JF, Griffith CH. A shortened instrument for literacy screening. *J Gen Intern Med* 2003;18:1036–8.
- [11] Golbeck AL, Ahlers-Schmidt C, Paschal AM. Health literacy and adult basic education assessments. *Adult Basic Education* 2005;15:151–68.
- [12] U.S. Department of Health and Human Services. *Healthy people 2010: understanding and improving health*. Washington, DC: U.S. Government Printing Office; 2000.
- [13] White S, Dillow S. Key concepts and features of the 2003 National Assessment of Adult Literacy (NCES 2006-471). Washington, DC: National Center for Education Statistics, U.S. Department of Education; 2005.
- [14] Nielsen-Bohlman L, Panzer AM, Kindig DA, editors. *Health literacy: a prescription to end confusion*. Washington, DC: National Academies Press; 2004.
- [15] Rothschild B. Health literacy: what the issue is, what is happening, and what can be done. *Health Promot Pract* 2005;6:8–11.
- [16] Schwartz L, Woloshin S, Black WC, Welch HG. The role of numeracy in understanding the benefit of screening mammography. *Ann Intern Med* 1997;127:966–72.
- [17] Parker RM, Baker DW, Williams MV, Nurss JR. The test of functional health literacy in adults: a new instrument for measuring patients' literacy skills. *J Gen Intern Med* 1995;10:537–41.
- [18] Quality Assessment and Accountability Systems. About CASAS. Available at: http://www.casas.org/casasnewweb/index.cfm?wtarget=body&selected_id=539. Accessed March 14, 2006.
- [19] Nurss JR, Parker RM, Williams MV, Baker DW. *Test of functional health literacy in adults (TOFHLA)*. Atlanta: Georgia State University; 1995.
- [20] U.S. Census. Department of Commerce, Bureau of the Census. *American fact finder*. Available at: <http://factfinder.census.gov>. Accessed March 8, 2005.