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Patients' Literacy Skills: More than just reading ability

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Abstract

Limited literacy contributes to suboptimal care and outcomes for patients. The Institute of Medicine noted that future work in health literacy should consider multiple literacy skills. However, lacking empirical evidence of the relationship between different literacy skills, reading skills are often used as proxies of literacy in research and practice. Using a community-based sample of 618 individuals residing in Boston, MA and Providence, RI, we conducted a principal component analysis on measures of four literacy skills: reading, numeracy, oral (speaking) and aural (listening) to examine whether and to what extent literacy can, or should, be represented by a single measure. The first principal component represented overall literacy and could only explain 60% of the total variation in literacy skills within individuals. The second principal component differentiated between numeracy/reading and the oral/aural exchange. While reading and numeracy best represent overall literacy, patients' relative strengths may vary. Those with moderate reading ability may have high oral and aural language skills. Conversely, people who have difficulties speaking with or understanding a provider may read well. Effective communication with patients should rely on both the oral exchange and written health information, and not rely on a single literacy skill.

Keywords

Literacy; Numeracy

Introduction

Many health providers recognize that the literacy levels of their patients may contribute to suboptimal care and outcomes. Limited reading skills are not only associated with a limited understanding of the concepts of risk, probability, and chronicity (Arnold, et al., 2001) but also with specific health risks, chronic diseases, and their associated treatment protocols (Gazmararian, Williams, Peel, & Baker, 2003; Kalichman & Rompa, 2000; Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005; Schillinger, et al., 2002). For example, individuals with limited literacy find it difficult to understand directions for taking medicine (Fang, Machtiger, Wang, & Schillinger, 2006; Kirsch, 2001; Kirsch, Jungeblut, Jenkins, & Kolstad, 1993), which may result in poorer adherence to a medication regimen (Gazmararian, et al., 2006; Lasater, 2003; Win & Schillinger, 2003). Individuals with lower reading skills are also less likely to engage in screening programs (Davis, et al., 2001;

Dolan, et al., 2004; Lindau, et al., 2002), to follow up after an abnormal test result (Lindau, Basu, & Leitsch, 2006), and to comply with treatment protocols or preoperative instructions (Chew, Bradley, Flum, & Cornia, 2004; Schillinger, et al., 2002). Finally, individuals with limited literacy may be less likely to become actively involved in healthcare choices, referred to as participatory decision-making, (IOM, 2003) and may face significant challenges in navigating the health system (Kirsch, et al., 1993; Rudd, Renzulli, Pereira, & Daltroy, 2005).

To improve quality of care and reduce disparities, patients' literacy skills must be acknowledged and addressed within the health care setting. The National Call to Action to Promote Health Literacy, released by the CDC in May, 2010, views limited health literacy as a public health problem (section 1) and has articulated 7 goals to deliver person-centered health information and services. The issue of limited literacy may become even more prominent in the health care setting with the passing of health care reform, as many formerly uninsured individuals will now have access to the health care system and given that approximately 9 out of every 10 Americans struggles to some extent with health promotion and disease prevention activities, effective navigation of the health care system, and management of one's health (Kirsch, et al., 1993), it is likely that a significant proportion of these individuals has limited literacy skills. As a result, health care providers need to have a better understanding of what constitutes health literacy to inform potential modifications to their materials, office procedures, or provider-patient interactions.

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". The Institute of Medicine (IOM) report (Ratzan & Parker, 2000) noted that health literacy studies need to expand the scope of literacy and include the five literacy skills used in education research: reading, writing, numeracy, oral (speaking), and aural communication (listening comprehension). The concept of health literacy is defined by both individual skills as well as the complexity of the tasks required in the health care system. (Institute of Medicine Committee on Health Literacy, 2004; Parker, Wolf, & Kirsch, 2008; Wolf, Davis, & Parker, 2007) To date, reading, and to a lesser extent numeracy, have been used as proxies for the broader construct of health literacy, with interventions focused on the development of grade-appropriate educational materials. (Institute of Medicine Committee on Health Literacy, 2004; Paasche-Orlow, et al., 2005) Other domains, such as oral and aural literacy are essential for participatory decision-making and for conveying symptoms, but have received much less attention in the health care setting and have not been the focus of efforts to improve the patient experience and patient outcomes.

While individual skills are theoretically distinct, there has been little research in the health field to examine the extent to which they overlap empirically. (Rudd, 2007) Further, research has yet to address the question of which skills should be prioritized for assessments in health research and practice given limited resources, and how health care providers may think about modifications in their own practice to improve quality and reduce disparities. This study addresses both of these outstanding questions by conducting a principal components analysis on four literacy skills important for health related activities: reading, numeracy, oral and aural communication, and examining the correlation of individual skills to the identified literacy components.

Methods

Study Population

Participants were offspring of pregnant women enrolled in the National Collaborative Perinatal Project (NCPP) between 1959 and 1966. (Niswander & Gordon, 1972) In 2001, the

New England Family Study (NEFS) was established to locate and interview the now-adult cohorts of the Providence, Rhode Island and Boston, Massachusetts NCPP sites (n=17,921). As part of the NEFS, 800 participants in their mid 40s were selected in 2004 for a study designed to assess pathways linking education and health (Gilman, et al., 2008); literacy was a central pathway of this study. Of these, 618 (77%) were successfully located and interviewed.

Measures

Literacy—We measured four literacy skills: reading comprehension, numeracy, oral language, and aural language. Reading comprehension, oral language, and aural language were assessed using subtests of the Woodcock Johnson III (WJ III), a standardized test normed against a representative U.S. population, ages 24 months to 90 years and older. (Woodcock, McGrew, & Mather, 2001) Grade equivalent scores (GE) were used in these analyses. While the WJ III tests are cognitive measures, and not measures of literacy or health literacy per se, in the absence of validated measures of the oral and aural exchange, these subtests represent the best available measures to assess these constructs quickly and reliably. Numeracy was assessed using an eight-item scale adapted from Lipkus et al. (Lipkus, Samsa, & Rimer, 2001) as described below.

Oral language was assessed by the WJ III achievement test “Story Recall,” where participants listen to a pre-recorded short story (1–3 paragraphs) and are then asked to repeat the story back to the interviewer. Scores are based on the correct number of words or phrases spoken. (Woodcock, et al., 2001) “Story Recall” is designed to measure aspects of oral language including language development and meaningful memory. The administration of this test is similar to commonly used “teach-back” methods that providers use to gauge patient communication, understanding and recall of health messages and instructions. “Story recall” has a median reliability of 0.89.

Aural language, or listening comprehension, was assessed by the WJ III achievement test “Understanding Directions,” where participants are given an illustrated drawing and are asked to follow pre-recorded directions to point to objects in the picture (e.g., “point to the blue book on the shelf”). Difficulty increases as drawings become more complex and the tasks increase in number of components. Scores are based on the number of correct tasks completed. This test was selected for its similarity to experiences in the health care setting, where providers give patients a set of instructions for taking their medicine or preparing for a medical procedure, for example. “Understanding directions” has a median reliability of 0.90.

Reading comprehension was assessed using the “Passage Comprehension” test from the WJ III Tests of Achievement—a cloze test, where individuals fill in missing words from a sentence. The one-year test-retest reliability was 0.92 and validation against the reading composite scores of the Kaufman Test of Educational Achievement (Kaufman, 1985) and the Wechsler Individual Achievement Test (Wechsler, 1992) show good validity with correlations of 0.81 and 0.78, respectively. (Woodcock, et al., 2001)

Numeracy was assessed using an eight-item scale. Two items were selected from general numeracy questions developed by Schwartz and colleagues, (Schwartz, Woloshin, Black, & Welch, 1997) and the remaining six were selected from an expanded seven-item numeracy scale developed by Lipkus and colleagues, where similar questions were asked within a health context. The 8 items focused on such tasks as discerning differences in magnitudes of health risks, performing mathematical operations on risk magnitudes, and converting percentages to proportions. Participants were provided a pencil and paper to perform calculations and responses were open-ended. The proportion of our sample who responded

correctly to each item is similar to that found in other samples. Numeracy scores were calculated based on the total number of correct responses (range: 0–8).

The decision not to implement the full Lipkus scale, while not ideal, was dictated by constraints on the total number of items in the questionnaire that were beyond our control. However, this reduced scale has good psychometric properties. Specifically, we conducted a factor analysis using the 8×8 matrix of tetrachoric correlations in Stata Version 10.1 using the procedure `factormat`. Tetrachoric correlations are usually used to assess the correlation among dichotomous variables. We considered an item to fall within a factor if its loading was 0.30 and above. We retained all factors with an eigenvalue of at least 1. All items are positively correlated. The first factor of the retained items explained 86.2% of the total variation. All items loaded positively on the first component with a loading of at least 0.41. All other factors had eigenvalues far below 1 (2nd largest eigenvalue =0.52). Combined, this suggests that the reduced scale is acceptable as a measure of numeracy.

Other health literacy assessments, such as the Rapid Estimate of Adult Literacy in Medicine (REALM) (Murphy, Davis, Long, Jackson, & Decker, 1993) and the Test Of Functional Health Literacy (TOFHLA) (Parker, Baker, Williams, & Nurss, 1995) were not included as part of the assessment due to constraints. Further, the REALM assesses health vocabulary specifically, rather than broader reading skills and the TOFHLA takes into account both reading and numeracy, making it difficult to isolate their relative effects.

Analysis

We computed all two-way Pearson correlations among health literacy skills. We also conducted a principal component analysis and computed the percentage of variation explained by each component. Finally, we computed the correlation between literacy skills and principal components.

Results

Table 1 displays the demographic composition and the range of scores in this sample. The sample contained 618 individuals between 38 and 47 years of age (mean= 42.4, sd =1.8) and contains more women than men (60.4% female). As expected in a New England sample, participants are predominantly white but the sample has a substantial black minority (78.1% non-Hispanic white, 16.8% non-Hispanic black and 5.2% Hispanic or other race). Average literacy skills are as follows: reading 12.4 (sd=4.8), oral language 7.7 (sd=4.5), aural language 7.9 (sd=4.3), numeracy 5.5 (sd=1.9).

All four literacy skills are positively correlated with one another (Table 2). The correlations ranged from .38 (oral language and numeracy) to .60 (reading comprehension and numeracy). All correlations are significant at $p < 0.0001$.

Table 3 summarizes the results from the principal component analysis. The first principal component explains 60% of the variation. The remaining three components explain 17%, 13%, and 10% of the variation, respectively. The first principal component has large positive correlations with all four skills and can be interpreted as an overall measure of health literacy. The second principal component, however, reflects a contrast between numeracy/reading and oral/aural language skills. The third principal component further separates oral and aural language, and the fourth principal component separates numeracy and reading comprehension.

Discussion

This is the first study to simultaneously examine four literacy skills considered to be core components of literacy: reading, numeracy, oral language and aural language. The first principal component represents an overall measure of literacy. While it captures 60% of the variation, 40% remains unexplained suggesting that measuring literacy is best captured by differentiating among multiple types of literacy skills. The first principal component is most highly correlated with reading and numeracy indicating that if resources allow only a single skill to be measured and addressed in practice; either numeracy or reading should be prioritized.

The second principal component represents differential literacy between numeracy/reading and oral/aural language. This suggests that people who are good at the oral/aural exchange may not necessarily be good at numeracy/reading and vice versa. To capture differential literacy, assessing and addressing challenges related to the oral exchange is desirable in addition to reading or numeracy skills. Oral language may be preferable as it is more highly correlated with the second principal component. The contrast in the second principal component makes intuitive sense as both numeracy and reading involve the use of written materials to accomplish health related tasks. Oral and aural language skills, on the other hand, capture the importance of the oral exchange in health as we often rely on mass communication to disseminate health messages and interpersonal communication between patients and providers to describe symptoms and treatment options effectively.

Patients have varying literacy skills and a high level of achievement in one skill does not necessarily imply a high level of achievement in another skill (Martin, et al.). Conversely, if a patient has difficulties reading, the patient may still be able to receive information effectively through other channels. More than one communication strategy is therefore desirable. This is consistent with the National Call to Action to Promote Health Literacy (U.S. Department of Health and Human Services, 2010) which expressed concern about an over-reliance on written communication. Reducing the complexity of written health information is desirable but may not suit the needs of patients who communicate most effectively through speaking and listening. Alternative strategies for communicating health information might include, for example, discussion groups, lectures and informal information meetings, as well as taped recordings such as a podcasts, or YouTube videos.

Although current assessments of health literacy focus primarily on reading ability, our analyses suggest the need for more comprehensive measures of health literacy. Future assessments would benefit greatly from assessing speaking and listening skills along with reading and numeracy. Computer-based assessments, for example, might integrate audio clips such as health messaging one might hear on the radio or excerpts from patient-physician conversations, and ask respondents to select the correct answer based on what they heard. Literacy tests in other domains have long done this: the Test of English as a Foreign Language (TOEFL) contains reading, listening, speaking and writing components as do tests of German literacy administered by the GOETHE institutes, which also contain a listening component.

Strengths of this study include its community-based sample and assessment of four of the five literacy skills identified by the IOM. However, our study is not without limitations. First, we did not have a measure of writing, and it is not known how writing correlates with the literacy dimensions identified in our analyses. Second, most of our literacy measures were not assessed within a health context and, thus, cannot be considered measures of “health literacy.” However, there are no currently available measures of the oral exchange in the health context. Measures used in this study capture relevant skills, are readily available,

normed, and validated. Future research, however, may also consider alternative measures of reading and numeracy such as the TOFHLA (Parker, et al., 1995) and the REALM (Murphy, et al., 1993) both of which approximate reading skills through the use of health related words and examples. Third, most participants were white and the age range in this sample is limited (38–47). While certain sub-groups such as the elderly may be at higher risk for low literacy we do not expect the relation between individual literacy skills to vary substantially by age. Strategies for effective communication may vary, however. For example, memory loss among older individuals may highlight a particular need for written directions for disease management in addition to the oral directions provided in the physician office.

While reading and numeracy best represent the construct of literacy, and are most often used in research as proxies for health literacy, providers, policy makers and researchers should not overlook the importance of the oral exchange as a distinct dimension of literacy essential to effective communication with patients.

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Table 1

Range of scores, mean and standard deviation for the four literacy skills measured

Characteristic	Mean (SD)	Min	Max
Education, years	13.6 (2.7)	7	21
Race			
White	78.1%		
Black	16.8%		
Hispanic/other	5.2%		
Gender			
Male	39.6%		
Female	60.4%		
Literacy Skills			
Reading	12.4 (4.8)	0.8	18
Numeracy	5.5 (1.9)	0	8
Oral language	7.7 (4.5)	0.5	18
Aural language	7.9 (4.3)	0	18

Table 2

Correlation among health literacy skills

Numeracy	1.00			
Reading	0.60	1.00		
Oral Communication (speaking)	0.37	0.43	1.00	
Aural Communication (listening)	0.45	0.47	0.45	1.00

Table 3

Correlations of 4 health literacy skills with their principal components. The proportion of variation explained by the components is given in the last row.

	Component 1	Component 2	Component 3	Component 4
Numeracy	0.79	-0.44	0.08	0.42
Reading	0.82	-0.31	0.14	-0.46
Oral Communication (speaking)	0.71	0.58	0.39	0.07
Aural Communication (listening)	0.76	0.24	-0.60	0.00
Proportion of Variation	0.60	0.17	0.13	0.10