Validation of Screening Questions for Limited Health Literacy in a Large VA Outpatient Population

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OBJECTIVES: Previous studies have shown that a single question may identify individuals with inadequate health literacy. We evaluated and compared the performance of 3 health literacy screening questions for detecting patients with inadequate or marginal health literacy in a large VA population.

METHODS: We conducted in-person interviews among a random sample of patients from 4 VA medical centers that included 3 health literacy screening questions and 2 validated health literacy measures. Patients were classified as having inadequate, marginal, or adequate health literacy based on the Short Test of Functional Health Literacy in Adults (S-TOFHLA) and the Rapid Estimate of Adult Literacy in Medicine (REALM). We evaluated the ability of each of 3 questions to detect: 1) inadequate and the combination of "inadequate or marginal" health literacy based on the S-TOFHLA and 2) inadequate and the combination of "inadequate or marginal" health literacy based on the REALM.

MEASUREMENTS AND MAIN RESULTS: Of 4,384 patients, 1,796 (41%) completed interviews. The prevalences of inadequate health literacy were 6.8% and 4.2%, based on the S-TOHFLA and REALM, respectively. Comparable prevalences for marginal health literacy were 7.4% and 17%, respectively. For detecting inadequate health literacy, "How confident are you filling out medical forms by yourself?" had the largest area under the Receiver Operating Characteristic Curve (AUROC) of 0.74 (95% CI: 0.69–0.79) and 0.84 (95% CI: 0.79–0.89) based on the S-TOFHLA and REALM, respectively. AUROCs were lower for detecting "inadequate or marginal" health literacy than for detecting inadequate health literacy for each of the 3 questions.

CONCLUSION: A single question may be useful for detecting patients with inadequate health literacy in a VA population.

KEY WORDS: health literacy; screening; validation; questions.
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INTRODUCTION

Health literacy is defined as "the degree to which individuals have the capacity to obtain, process, and understand basic health-related decisions."[1] Approximately 90 million American adults may lack the needed literacy skills to effectively use the US health care system.[2,3] Poor health literacy has been associated with poor health outcomes such as poorer health knowledge, poorer medication adherence, poorer control of chronic illness, and higher hospitalization rates.[4–9]

Limited health literacy is often underrecognized by health care providers.[10] Patients may be ashamed of their limited skills and do not disclose their difficulties to their health care providers.[11,12] However, routine screening is controversial. Despite the availability of valid health literacy assessment tools,[13–15] these instruments are time-consuming and not practical in busy clinical settings. Some experts worry that screening may embarrass patients and could stigmatize those with poor health literacy.[16,17] Although the value of screening depends on what is done with the information, the development of a rapid and inexpensive way to identify patients with limited health literacy would increase the feasibility of assessing a patient's health literacy in a busy clinical setting or of conducting large-scale studies that could evaluate the consequences of limited health literacy and identify effective interventions.

One approach to screening for health literacy is based on an individual's level of self-reported difficulty with understanding information or performing reading tasks they encounter in the health care setting. Previous studies have shown that a single question may be useful for identifying individuals with special

communication needs. The question "How often do you have someone help you read hospital materials?" was predictive of inadequate health literacy in a sample of male patients at a VA preoperative clinic[18] and a sample of patients at a university-based vascular surgery clinic.[19] This same question performed reasonably well in ruling out inadequate health literacy in adults.[20] Another study found "How confident are you filling out forms by yourself" to perform best in identifying patients with limited health literacy at a university-based primary care clinic.[21] Although the results suggest a single question can be used to screen patients for inadequate health literacy, each of these studies recruited convenience samples of patients in 1 setting, and the 2 studies used different instruments as the gold standard to classify patients with limited health literacy. We therefore evaluated the performance of 3 single-item screening questions for identifying patients with: 1) inadequate health literacy and 2) "inadequate or marginal" health literacy based on the 2 most widely used health literacy assessment instruments, the Short Test of Functional Health Literacy in Adults (S-TOFHLA) and the Rapid Estimate of Adult Literacy in Medicine (REALM), in a large, random sample of primary care patients at 4 VA Medical Centers.

METHODS

This observational study involved face-to-face interviews with 1,796 veterans who received primary care services at 1 of 4 large VA medical centers: Minneapolis, MN; West Los Angeles, CA; Durham, NC; and Portland, OR. The Institutional Review Board at each site approved the study protocol. Study sites were purposively chosen based on patient population size and demographic and geographic diversity. Each study site conducted a pilot study of 10 to 20 interviews before formal data collection, to refine data systems, recruitment strategies, and interview protocol, and to ensure proper coordination across sites.

STUDY POPULATION

The sampling frame for the study included all patients at the 4 study facilities who were scheduled to have at least 1 primary care visit during the study recruitment period (June 2004 to May 2005) and who did not suffer from a severe cognitive disorder or blindness based on medical record reviews. Because age is strongly associated with health literacy[22] and not equally distributed across the study sites, the sampling was stratified by age (<50, 50–75, >75 years). Patients within each age stratum were randomly sampled from a list of eligible participants at each site.

Study Protocol

Introductory letters were sent to eligible randomly selected patients at each site to introduce them to and invite them to participate in the study. A subsequent telephone call served as the primary method of recruitment because patients with limited health literacy may not be able to read or fully comprehend the letter. Study recruiters telephoned each potential participant to determine their willingness to participate and verify their eligibility (i.e., no severe cognitive or vision impairment, English fluency). Six attempts were made to reach potential participants. Patients who were willing to participate scheduled a 1-hour interview, usually on the same day as a primary care appointment. Participants were offered $25 to compensate them for their time.

Interviewers at each site completed 16 hours of training. Interviewers screened and recruited participants for visual and cognitive impairments. Cognitive impairment was assessed using the Mini-Cog, a brief, validated screen for dementia.[23] Patients who screened positive for dementia or with corrected visual acuity of 20/100 or worse were excluded from the study. Informed consent was obtained in person before the interview. For all participants, research assistants read aloud a series of questions on demographic and socioeconomic characteristics, and social support before guiding participants through the 3 health literacy screening questions and then the 2 health literacy assessments, the S-TOFHLA and REALM.

MEASURES

Demographics

Data collected at the interview included single-item questions for age, marital status, household income, occupation and occupational status, years of schooling, and race/ethnicity, most taken from the US census.

Health Literacy Screening Questions

The 3 health literacy screening questions, which performed optimally in a previous study, were included: "How often do you have someone (like a family member, friend, hospital/clinic worker or caregiver) help you read hospital materials?" (Help Read), "How often do you have problems learning about your medical condition because of difficulty understanding written information?" (Problems Reading), and "How confident are you filling out forms by yourself?" (Confident with Forms).[18] Responses were scored on a Likert scale from 0 to 4, but the wording of the response choices for 2 of the 3 questions (Help Read and Problems Reading) varied slightly from the published responses. Instead of *always, often, sometimes, occasionally,* or *never,* participants were asked to choose between *all of the time, most of the time, some of the time, a little of the time* or *none of the time* to improve participant understanding.

Interview Comparison Standards

Because of the wide use of both the S-TOFHLA and REALM in health literacy research, we used 2 sets of interview comparison standards against which we evaluated each of the 3 questions: 1) inadequate health literacy and the combination of either "inadequate or marginal" health literacy based on the S-TOFHLA and 2) inadequate health literacy and the combination of either "inadequate or marginal" health literacy based on the REALM.[13,14]

The REALM measures word recognition of 66 common medical terms. Scores are most often categorized into grade levels (<3rd grade, 4–6th grade, 7–8th grade, high school). We recoded REALM scores into <6th grade, 7–8th grade and high school, allowing for categories comparable to the S-TOFHLA, which are referred to in this report as inadequate, marginal, and adequate health literacy.[14]

The S-TOFHLA includes both a numeracy component and reading comprehension assessment. For the reading comprehension assessment, each participant was timed and given 7 minutes to complete the questions, which is standard protocol for the S-TOFHLA. Incomplete questions were scored as incorrect. S-TOFHLA scores range from 0 to 100 and are then categorized into inadequate, marginal, and adequate skills using established cutoff scores (inadequate 0–53; marginal 54–66; adequate 67–100).[13] For all participants, the health literacy screening questions were administered first, followed by the REALM, and then the S-TOFHLA.

ANALYSIS

We first scored the 3 screening questions by assigning the values 0, 1, 2, 3, and 4 to the 5 possible responses to each of the questions, with higher scores reflecting greater problems with reading.

We compared the accuracy of the individual screening questions to the 2 comparison standards (inadequate health literacy and the combination of "inadequate or marginal" health literacy) based on each of the S-TOFHLA and the REALM. We then computed sensitivity, specificity, and positive and negative likelihood ratio (LR) with 95% confidence intervals (CI).[24] Positive and negative LRs allow for simultaneous evaluation of the sensitivity and specificity at each threshold.[25] Receiver operating characteristic (ROC) curves plot the sensitivity versus (1-specificity). The ROC curves allowed us to review the trade-offs involved between improving either a question's sensitivity or its specificity. An ideal question is one that achieves an area of 1; an area under the ROC of 0.5 indicates a screen that provides no useful information. Areas under the ROC curve (AUROC) are presented to compare the overall performance of the screening questions, and significant differences between AUROCs were tested using the SAS macro *%ROC* (SAS® Institute). The macro takes into account the correlation existing between any 2 computed AUROC's due to evaluating the 2 screening questions in the same sample of patients.[26]

To determine whether combining questions could improve the screening performance, we evaluated the performance of various combinations of questions. We scored all combinations of 2 questions and the combination of all 3 questions by first assigning scores (0–4), as described above, to all the possible responses to each individual question. We then summed the scores to obtain the score for the combination of questions, thus resulting in scores ranging from 0 to 8 for each of the 2-question combinations and 0 to 12 for the 3-question combination. The SAS macro %ROC was used to determine whether the AUROCs of any of the 2- or 3-item combinations of screening questions was significantly greater than the AUROC corresponding to the individual screening question with the best performance for detecting inadequate heath literacy and the combination of "inadequate or marginal" health literacy. Because we were interested in the predictive value of these questions alone, we did not adjust for potential confounders in our analysis.

RESULTS

Of the 4,384 patients randomized into the study, 3,850 (87%) were contacted by telephone and asked to participate, and of those contacted, 481 (12%) were not eligible. With 1,796 participants completing the in-person interview, the overall response rate was 41% and the cooperation rate was 53%.[27] Among the 1,796 participants, the prevalence rates of inadequate and marginal health literacy were 6.8% and 7.4%, respectively, as measured by the STOHFLA, and 4.2% and 17%, respectively, as measured by the REALM (Table 1).

To explore the implications of the high non-response rate, we compared participants to non-participants with respect to age, education, and income. Non-participants compared to participants were more likely to be older (mean age 62.5 vs 61.1 years, p=0.02), less likely to have completed high school education (93.5% vs 94.9%, p<0.01), and more likely to have a household income less than $20,000 (24% vs 19%, p<0.01).

Detecting Inadequate Health Literacy

Using the interview comparison standards based on the S-TOFHLA, we found that the AUROC's of the 3 screening questions for detecting inadequate health literacy ranged from 0.66 to 0.74, with "Confident with Forms" performing better than all other questions (p<0.05) (Table 2). Using the REALM

Table 1. Characteristics of Study Participants (*N*=1796)

Characteristics	*N*	(%)
Age (years)		
< 50	537	29.9
50–75	748	41.6
> 75	511	28.5
Gender		
Female	246	13.7
Male	1,550	86.3
Race		
White	1,299	72.3
Black	334	18.6
Other	156	8.7
Unknown	7	0.4
Annual Income		
< $20,000	613	34.1
$20,000 – 40,000	647	36.0
> $40,000	536	29.8
Education		
< Grade 11	164	9.1
High school graduate	447	24.9
Some College	727	40.5
College graduate/MS/PhD	447	24.9
Unknown	11	0.6
Currently Working		
Yes	590	32.8
No	1,195	66.5
Unknown	11	0.6
Health Literacy Level based on S-TOFHLA†		
Inadequate	123	6.8
Marginal	132	7.4
Adequate	1,541	85.8
Health Literacy Level based on REALM‡		
Inadequate	75	4.2
Marginal	306	17.0
Adequate	1,408	78.4

†*Health literacy level based on S-TOFHLA (Short Test of Functional Health Literacy in Adults) score: inadequate health literacy (0–53), marginal health literacy (54–66), and adequate health literacy (67–100)*
‡*Health literacy level based on REALM (Rapid Estimate of Adult Literacy in Medicine) score: inadequate health literacy (less than 6th grade reading level, 0–44), marginal health literacy (7–8th grade reading level, 45–60), and adequate health literacy (high school reading level, 61–66).*

Table 2. Areas Under the Receiver Operating Characteristic Curve and 95% CI for the Health Literacy Screening Questions (*N*=1,796)

Screening Questions	S-TOFHLA		REALM	
	Health Literacy		Health Literacy	
	Inadequate	Inadequate or Marginal	Inadequate	Inadequate or Marginal
	(*N*=123)	(*N*=255)	(*N*=75)	(*N*=381)
How confident are you filling out forms by yourself? ("Confident with Forms")	0.74 (0.69–0.79)	0.72 (0.69–0.76)	0.84 (0.79–0.89)	0.71 (0.68–0.74)
How often do you have someone help you read hospital materials? ("Help Read")	0.67 (0.62–0.72)	0.63 (0.59–0.66)	0.72 (0.67–0.79)	0.62 (0.60–0.65)
How often do you have problems learning about your medical condition because of difficulty reading hospital materials? ("Problems Reading")	0.66 (0.61 – 0.71)	0.63 (0.61–0.67)	0.72 (0.65–0.78)	0.63 (0.60–0.66)

to determine our interview comparison standard of inadequate health literacy, we found the AUROC for the screening questions ranged from 0.72 to 0.84 (Table 2), with "Confident with Forms" again performing significantly better than the other 2 questions ($p<0.05$), (Table 2).

Sensitivities, specificities, and positive and negative LRs with 95% CI for the 3 screening questions for detecting inadequate health literacy based on the S-TOFHLA and REALM at each threshold are shown in Table 3. The screening threshold that optimized both sensitivity and specificity for "Confident with Forms" was at the response of "*Somewhat*" or less. The specificity for inadequate health literacy at this threshold was more than 82% based on either comparison standard, but the sensitivity was lower on the S-TOFHLA than on the REALM (60% and 83%, respectively). At this threshold, assuming the prevalence in this sample, the proportion of patients accurately identified (true positives and true negatives) with "Confident with Forms" was 80% based on the S-TOFHLA and 81% on the REALM.

Detecting the Combination of "Inadequate or Marginal" Health Literacy

The single-item screening questions were less effective as screening tests for the combination of either "inadequate or marginal" health literacy defined by either the REALM or S-TOFHLA (Table 2). The AUROCs for identifying patients with "inadequate or marginal" health literacy were consistently lower than those for identifying patients with inadequate health literacy, with the former ranging from 0.62 to 0.72.

Combinations of the 3 Screening Questions

When all combinations of the 3 screening questions were considered, we found that no combination of these questions significantly increased the AUROC in detecting inadequate health literacy or the combination of "inadequate or marginal" health literacy defined by either the S-TOFHLA or the REALM above the AUROC for the most effective single question, "Confident with Forms."

DISCUSSION

To our knowledge, this is the first large multicenter study that validates brief screening questions for detecting inadequate health literacy. Using either the REALM or the S-TOFHLA as the gold standard, the question "Confident with Forms" performed significantly better for detecting patients with inadequate health literacy than the other 2 questions. For identification of the broader group of patients with either "inadequate or marginal" health literacy, the individual performance of each of the 3 health literacy screening questions was weaker.

This study had important strengths. We recruited a random sample of patients from multiple VA centers to obtain a more representative sample of the patient population and improve the generalizability of our findings. In addition, the large sample size allowed us to estimate the performance of these questions with much greater precision. Finally, this is the first study that compared the performance of the screening questions against 2 commonly used health literacy assessments, the REALM and the S-TOFHLA in the same sample.

The REALM and S-TOFHLA are the most widely used measures for health literacy. Each has been shown to predict knowledge, behaviors, and outcomes. Although these 2 tests are highly correlated,[13] we discovered that the performances of the questions had a higher AUROC when the interview comparison standards were defined by the REALM compared to the S-TOFHLA. It is likely that the REALM and the S-TOFHLA measure different capacities.[28] The REALM is a word recognition and pronunciation test that measures the domain of vocabulary. The S-TOFHLA measures reading fluency and consists of a reading comprehension section to measure prose literacy.

The optimal cut point of a screening test in a particular setting depends on several factors including test accuracy, prevalence of inadequate health literacy, costs of testing and false positive classification and the benefits of identifying true positives. If the objective of screening is to detect most persons who lack sufficient reading skills, we would want to choose a test cutoff with high sensitivity and low negative likelihood ratio so that persons who test negative are very likely to have adequate reading skills. However, if the objective of screening is to correctly identify those persons with low health literacy, one would choose a test cut cutoff with high specificity and high positive likelihood ratio so that persons who test positive are very likely to have inadequate health literacy. However, the implications of a positive or negative test vary dramatically depending on the prevalence of inadequate health literacy in the screened population. For example, a response of "Somewhat" will be the optimal screening threshold for Confident with Forms, in many settings. Using the sensitivity and

Table 3. Performance of Health Literacy Screening Questions for Detecting Inadequate Health Literacy (*N*=1,796)

Question	AUROC* (95%CI)	Sensitivity	Specificity	+ LR (95%CI)	–LR (95%CI)
S-TOFHLA					
Confident with Forms†					
≤ 0 Extremely	0.74 (0.69–0.79)	1.00	0.00	1.00	
≤ 1 Quite a bit		0.80	0.49	1.58 (1.40–1.77)	0.40 (0.27–0.60)
≤ 2 Somewhat		0.60	0.82	3.37 (2.71–4.19)	0.48 (0.37–0.64)
≤ 3 A little bit		0.33	0.94	5.15 (3.17- 8.38)	0.72 (0.58–0.89)
≤ 4 Not at all		0.10	0.98	5.42 (0.94–31.43)	0.92 (0.76–1.11)
Help Read‡					
≥ 0 None of the time	0.67 (0.62–0.72)	1.00	0.00	1.00	
≥ 1 A little of the time		0.58	0.71	2.04 (1.64–2.54)	0.58 (0.44–0.77)
≥ 2 Some of the time		0.47	0.83	2.67 (1.98–3.61)	0.65 (0.51–0.82)
≥ 3 Most of the time		0.30	0.90	2.87 (1.69–4.85)	0.79 (0.64–0.97)
≥ 4 All of the time		0.16	0.96	3.70 (1.34–10.22)	0.87 (0.72–1.06)
Problems Learning§					
≥ 0 None of the time	0.66 (0.61–0.71)	1.00	0.00	1.00	
≥ 1 A little of the time		0.62	0.63	1.80 (1.55–2.28)	0.60 (0.45–0.81)
≥ 2 Some of the time		0.48	0.79	2.89(2.24–3.74)	0.66 (0.51–0.84)
≥ 3 Most of the time		0.25	0.94	4.45 (2.20–9.00)	0.80 (0.65–0.98)
≥ 4 All of the time		0.09	0.98	8.44 (1.96–36.32)	0.93 (0.77–1.12)
REALM					
Confident With Forms†					
≤ 0 Extremely	0.84 (0.79–0.89)	1.00	0.00	1.00	—
≤ 1 Quite a bit		0.91	0.49	1.77 (1.60–1.95)	0.19 (0.09–0.40)
≤ 2 Somewhat		0.83	0.82	4.77 (3.92–5.39)	0.21 (0.12–0.36)
≤ 3 A little bit		0.43	0.93	6.50 (4.18–10.12)	0.61 (0.45–0.83)
≤ 4 Not at all		0.16	0.99	9.09 (2.37–34.89)	0.86 (0.67–1.09)
Help Read‡					
≥ 0 None of the time	0.72 (0.67–0.79)	1.00	0.00	1.00	—
≥ 1 A little of the time		0.67	0.71	2.30 (1.86–2.85)	0.47 (0.32–0.70)
≥ 2 Some of the time		0.59	0.82	3.31 (2.52–4.35)	0.50 (0.35–0.71)
≥ 3 Most of the time		0.47	0.90	4.61 (3.14–6.77)	0.59 (0.44–0.81)
≥ 4 All of the time		0.23	0.95	5.04 (2.04–12.46)	0.81 (0.63–1.05)
Problems Learning					
≥ 0 None of the time	0.72 (0.65–0.78)	1.00	0.00	1.00	—
≥ 1 A little of the time		0.70	0.63	1.88 (1.55–2.28)	0.47 (0.31–0.72)
≥ 2 Some of the time		0.61	0.79	2.89 (2.24–3.74)	0.50 (0.34–0.71)
≥ 3 Most of the time		0.28	0.94	4.45 (2.20–9.00)	0.77 (0.58–1.00)
≥ 4 All of the time		0.15	0.98	8.44 (1.96–36.32)	0.87 (0.68–1.11)

**AUROC area under the ROC curve*

† *"Confident with Forms"—How confident are you filling out forms by yourself?*

‡ *"Help Read"—How often do you have someone help you read hospital materials?*

§ *"Problems Learning"—How often do you have problems learning about your medical condition because of difficulty reading hospital material?*

specificity from the REALM (83% and 82%, respectively) and the prevalence of inadequate health literacy of 4.2% from our study sample, "Confident with Forms" would result in a posttest probability of inadequate health literacy of 21% at this cut point.[29] If the same cut point was used for "Confident with Forms" in a setting with a higher prevalence of inadequate health literacy (35%) as reported in a previously published study,[30] a positive screen would raise the posttest probability of inadequate health literacy to 76%.

Because the S-TOFHLA and REALM are not practical in busy clinical settings, a single question to screen for inadequate health literacy may be useful in clinical practice and research. The question "Confident with Forms" could be asked unobtrusively in busy clinical settings and may be less likely to induce anxiety or shame. Patients who screen positive for inadequate health literacy could be offered interventions using special methods of communication and assistance to allow them to successfully navigate the health care system. Finally, a single screening question could increase the feasibility of conducting needed research to develop effective interventions for patients with poor health literacy.

This study has several limitations. First, our study was conducted in a large population of VA primary care patients that may not be generalizable to other settings. Owing to the small proportion of women in our study, we were unable to determine whether the predictive abilities of these questions differed among women and men. However, our results were similar to those of Wallace[21] who recruited patients from a university-based primary care clinic that suggests that the performance of these questions in other clinical settings may be similar. Second, our participation rate for this study was 41%. The comparison of respondents to non-respondents demonstrated the non-respondents were more likely to be older, have lower educational attainment, and have lower socioeconomic status, which suggests that non-respondents may have had lower health literacy than participants. This would have underestimated the prevalence of inadequate and marginal health literacy and could have resulted in a biased assessment of screening performance. Third, this study did not evaluate demographic characteristic such as age and education alone or in combination with the screening questions. These characteristics may be an alternative method to quickly identify patients with low health literacy.

In summary, we confirmed results from a previous study that the question "Confident with Forms" may be useful for detecting patients with inadequate health literacy in a VA population. Given the documented association of poor health literacy and health outcomes, these questions are an important advance toward being able to practically identify patients who might have difficulty understanding and acting on health care information.

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