Health Literacy Assessment via STOFHLA: Paper vs Computer Administration

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Abstract

Background. Low health literacy affects more than one-third of American adults, resulting in poor physician-patient communication, worse health outcomes, and increased medical costs. Many physicians are uninformed of their patients' health literacy status. Current paper-based surveys require extra staff, time, and resources for administration, while a computer-based survey may provide efficient assessment to increase provider awareness. The study assessed the efficacy of a computer-based health literacy test compared to an established, paper-based format for use in an office setting.

Methods. A prospective, non-blinded, randomized experimental design was conducted. A brief demographic survey and health literacy test (STOFHLA) was administered to 100 adult subjects at a Midwestern family medicine residency clinic. Recruitment flyers were distributed in the office and all eligible, willing patients were randomized to one of two groups. Fifty participants were administered the paper test and 50 were administered the computer-based test.

Results. The majority of subjects had "adequate" health literacy (85%) and completed the test within the allotted time period (82%). When comparing the paper and computer groups, there were no statistically significant differences for demographics, test scores, or completion time.

Conclusions. A computer-based health literacy test is as effective as an established, paper-based format to assess health literacy in a family medicine office population. Future research studies should investigate the impact of having patient health literacy scores available to the physician prior to the office visit and how it may affect communication, compliance, and health outcomes.
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Introduction

Health literacy is an important factor in medicine that has been associated with patient-physician communication, health outcomes, and costs.[1,2] According to Healthy People 2010, health literacy is the "degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions and follow instructions for treatment."[3] Health literacy is one of the strongest predictors of health status, surpassing education level, income, and ethnicity.[4]

More than one-third of American adults have marginal health literacy and suffer significant consequences.[3] Low health literacy is associated independently with poor health outcomes.[1,4] In one study, 33% of diabetic patients with adequate literacy had good control of hemoglobin levels ($HgA_{1c} \leq 7.2\%$) compared to only 20% of low-literacy patients.[5] Another study found that Medicare patients were 29% more likely to be hospitalized if they had low health literacy.[6] Patients with inadequate health literacy were subject to increased medication errors, missed appointments, and decreased access to health care.[7] Inadequate health literacy costs an estimated $73 billion dollars in extra health care services.[8] Furthermore, poor patient-physician communication associated with low health literacy may lead to increased malpractice suits.[4]

Despite these consequences, most health care providers are unaware of their patients' health literacy status. While low-health literacy was associated with identifiable risk factors such as increased age, limited education, and certain ethnic minorities, providers do not predict health literacy skills reliably based on demographic factors or appearance alone.[9,10] Further, patients are unlikely to admit their low-literacy status or lack of comprehension to health care providers.[10]

Finally, low health literacy affects all segments of the population.[10] For these reasons, providers should use a "universal precautions" approach with all patients.[1,3,11] However, providers may have limited time during clinical encounters to use tools which improve communication with low health literate patients. Thus, health literacy assessment could potentially identify patients who require extra time and resources for improved communication and patient care.[4]

Numerous instruments for testing health literacy have been validated and typically are administered verbally.[5] For example, the Rapid Estimate of Adult Literacy in Medicine (REALM)[12] and the Test of Functional Health Literacy in Adults (TOFHLA)[13] involve scoring patients' pronunciation of medical words. The Newest Vital Sign[14] evaluates patients' ability to understand a nutrition label. The Short Test of Functional Health Literacy in Adults (STOFHLA) uses fill-in-the-blank passages taken from medical instructions that patients might encounter, and takes seven minutes to administer. The STOFHLA has been validated, and demonstrated comparable results to the REALM and TOFHLA.[6]

Currently, most health literacy assessment tools are administered via a paper-based format.[6,15,16] Little is known about using a timed, computer-based test. A computer format may be more cost-effective and efficient for practices to implement, especially if integrated into web-based check-in systems and electronic medical records.

This study's objective was to evaluate if a paper-based assessment tool can be utilized in a computer format and provide comparable results, thus providing the basis for further validating the tool's use through computer administration. The STOFHLA was chosen for this study due to its convenience, the structure of the assessment as a viable option for a computer administration, and its ability to administer via computer without audio assistance devices.

Methods

A brief demographics survey and the STOFHLA were administered to 100 adult subjects at a Midwestern family medicine residency clinic. The study was approved by two local Institutional Review Boards.

Subject selection criteria and sample size justification. Adult patients or parents of child patients were asked to participate in this study when checking-in for a scheduled medical appointment. The eligibility criteria for participation in this study included: (1) English-speaking, (2) adult ($\geq$ 18 years of age), (3) able to use a computer, and (4) able to provide informed consent. One hundred surveys were needed to achieve 90% power. Approximately 525 patients were seen at the clinical site each week.

Recruitment. A recruitment information sheet about the research was provided to all eligible participants when they checked-in for their scheduled appointment. The Flesch-Kincaid[17] readability of recruitment fliers was at the 7.1 grade level. Those who agreed to participate met with one of the investigators to learn more about the study, its requirements, and eligibility. Each willing participant signed an informed consent form.

The session included a survey for demographics and technology use, followed by the timed (7 minute) Short Test of Functional Health Literacy in Adults.[12] Technology experience was scored on a scale of 1-6, with one equal to low experience and six equal to high experience. Technology self-efficacy was assessed as a composite score from four statements; the minimum score was 5 and maximum score 20. Subjects were randomized to receive the test either via a computer-based system or a paper form. Fifty subjects received each type of test format.

Study instructions were read to each participant by one of the investigators. The standard STOFHLA was transferred to a digital format and delivered via a laptop for the computer group. The computer version was designed to resemble the test format (i.e., instructions and number of questions) and layout of questions (i.e., sentences and corresponding word-choice options) of the paper version. Administration of the STOFHLA for both groups was conducted using standard procedure, scoring, and interpretation (see Table 1). All participants received a $15 gift card upon their study completion.

Data analysis procedures. Data were managed using the Statistical Package for the Social Sciences (SPSS version 17.0; Chicago, IL). Descriptive statistics were tabulated. Univariate comparisons between subgroups of participants used Pearson's chi-square for categorical variables (with Fisher's correction if needed). For continuous variables, independent samples t-tests or ANOVA were used to compare non-skewed variables or Mann Whitney or Kruskal Wallis tests for non-normal distributions. All statistical tests were two-tailed and alpha was set at 0.05.

Table 1. Interpretation of the STOFHLA raw scores.*

Raw score	Interpretation
0-16	Inadequate: may be unable to read and interpret health texts
17-22	Marginal: has difficulty reading and interpreting health texts
23-36	Adequate: can read and interpret most health texts

*Adopted from Barber et al.[18]

Results

One hundred participants from a single family medicine residency clinic completed the study. Subjects were primarily female (82%), white (62%), and had an annual household income less than $20,000 (72%). The age distribution of participants was: 27%, 21-30 years old; 17%, 31-40 years old; 21%, 41-50 years old, and 24%, 51 years old and older. Participants who were married, never married, or not now married were distributed evenly (33.7%, 32.7%, and 33.7% respectively). Most participants had either high school graduation equivalence (37%) or attended college for less than 4 years (35%).

Thirty percent of participants described themselves as "up-to-date with technology". The next most common descriptors (19% each) were: "I don't have time to keep up with the latest technology" and "I immerse myself in technology as a hobby". When asked about their experience with technology, the majority reported using computers (69%) and cellular/mobile phones (83%) on a daily basis. The majority "agreed" or "strongly agreed" that they were: comfortable using a computer on their own (77%), confident in their abilities to use most technological devices (80%), and self-sufficient using a new technology after only a short training (80%). Technology self-efficacy and experience did not differ between computer and paper groups (Table 2).

The majority of subjects completed the STOFHLA within the 7-minute time (82%). The median score on the health literacy test was 33 (mean = 30.97, SD = 6.21, range = 10-36). The individual's functional health literacy score on the test was interpreted as being in one of three levels (see Table 1). The majority of the participants were rated as having "adequate" health literacy (85%); 11% were "marginal" and 4% were "inadequate". The characteristics of the two groups are displayed in Table 2. The two groups did not differ statistically by race, age group, education level, employment, or income level.

For the computer and paper test administrations, the majority of subjects had adequate health literacy (86% and 84% respectively). Twelve percent of participants in the computer group had marginal health literacy compared to 10% of the participants in the paper group. Those with inadequate health literacy were at 2% and 6%, respectively. STOFHLA scores did not differ significantly between paper (mean = 31.0, SD = 6.77) and computer (mean = 30.9, SD = 5.67) groups ($t(98) = 0.48$, $p = 0.96$; Table 3). For both computer and paper administration, the majority of people (84% and 80% respectively) completed the STOFHLA within the allotted 7-minute testing period, and there was no significant difference between groups, χ^2 (1, N = 100) = 0.27, p = 0.60.

Finally, the participants' comfort level with using computers did not impact their health literacy score significantly based on which type of test they were administered ("comfortable", paper version, mean = 31.8, SD = 6.28, "comfortable", computer version, mean = 31.9, SD = 4.67, t(66) = -0.088, p = 0.93; "uncomfortable", paper version, mean = 25.67, SD = 8.64; "uncomfortable", computer version, mean = 25.00, SD = 3.61, t(7) = 0.651, p = 0.53).

Discussion

Health literacy is a significant indicator of health status, and assessment has the potential to enhance patient care. Busy schedules and limited appointment times call for an efficient assessment tool. Implementing a computer-based test may be more cost-effective and efficient than a paper-based method for incorporation into an office practice. A computer-based survey could be completed prior to an office visit, such as at a computer in the office waiting room or at home through a web-based check-in service.

In the advent of electronic medical records systems, a computer-based survey could be integrated into the flow of the office system and recorded in the patient's electronic medical chart. Depending on the implementation strategy chosen, initial costs may include the purchase of a dedicated computer or kiosk. Administering this

Table 2. Demographic comparisons for paper vs. computer groups.

DEMOGRAPHICS	**Paper (n=50)**	**Computer (n=50)**	Test	df	p-value
	%	%	χ^2		
RACE					
White	73%	54%	3.771	1	.052
Non-white	27%	46%			
AGE GROUP					
18-20 years old	8%	14%			
21-30 years old	22%	32%	7.631	4	.106
31-40 years old	20%	14%			
41-50 years old	16%	26%			
51+ years old	34%	14%			
EDUCATION					
Less than High School or GED	16%	16%			
Grade 12 or GED	42%	32%	4.323	3	.229
College 1-3 Years	26%	44%			
College 4+ Years	16%	8%			
EMPLOYMENT					
Not working	66%	54%	1.500	1	.221
Working	34%	46%			
INCOME					
Less than $20,000	76%	68%	.794	1	.373
Greater than $20,000	24%	32%			
	Mean (SD)	Mean (SD)	t	df	P-value
TECHNOLOGY EXPERIENCE	1.75 (.85)	1.84 (.93)	-.56	98	.577
TECHNOLOGY SELF-EFFICACY	19.5 (3.7)	19.4 (2.9)	.073	91	.942

Table 3. Health literacy outcome comparisons for STOFHLA paper vs. computer.

STOFHLA OUTCOMES	**Paper (n=50)**	**Computer (n=50)**	Test	df	P- value
	%	%	χ^2		
COMPLETED IN 7 MINUTES					
Yes	80%	84%	.271	1	.603
No	20%	16%			
STOFHLA SCORE CATEGORY					
Inadequate	6%	2%	1.103	2	.576
Marginal	10%	12%			
Adequate	84%	86%			
	MEAN (SD)	MEAN (SD)	t	df	P-value
STOFHLA SCORE	31.0 (6.8)	30.9 (5.7)	.048	98	.962

computer-based test may not require additional dedicated personnel or on-going resources, which could decrease its cost compared to a paper-administered version.

This study demonstrated that a computer-based health literacy test was comparable to the paper-based form in the study setting. The two groups were similar in health literacy score and time required to complete the survey. Moreover, there were no differences in demographics to confound the results and both groups had similar technology experience and self-efficacy scores. In the overall study sample, slightly less than a quarter of participants did not feel comfortable using computers. Those patients may need occasional assistance with computerized testing until their confidence and comfort levels improve. These findings suggested that a computer-based STOFHLA test could be used in an office setting to assess patients' health literacy accurately.

Unfortunately, many health care providers are unaware of their patients' health literacy status. As previously noted, low health literacy was associated with decreased access to medical services and poor health outcomes. Increasing provider awareness of their patients' understanding of health concepts may improve communication, health care access, and overall health outcomes.

Limitations. This study population was limited to a single clinical site in a Midwestern location. The sample size was low, as is typical in preliminary studies involving the testing of technology as an application for assessing patient skills and knowledge. The results of the health literacy rates may not be representative of the overall population. Although the type of test administered (paper-based or computer-based) was randomized, participant selection was not randomized. The results may be generalizable only to tests using desktop or laptop computers, and not to other technology such as kiosks or touch screens. These variations provide an area of future research.

Conclusions

A short, computer-based test is an accurate method to assess health literacy in a family medicine office population. Previous studies have revealed the link between low health literacy and poor health status. Future research studies need to be conducted to assess the implementation of a computer-based health literacy assessment and its effect on patient care. There is a need to investigate the impact of having patient literacy scores available to the physician prior to the office visit and how it may affect physician-patient communication, medication compliance, and long-term health outcomes within the patient-centered medical home.

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