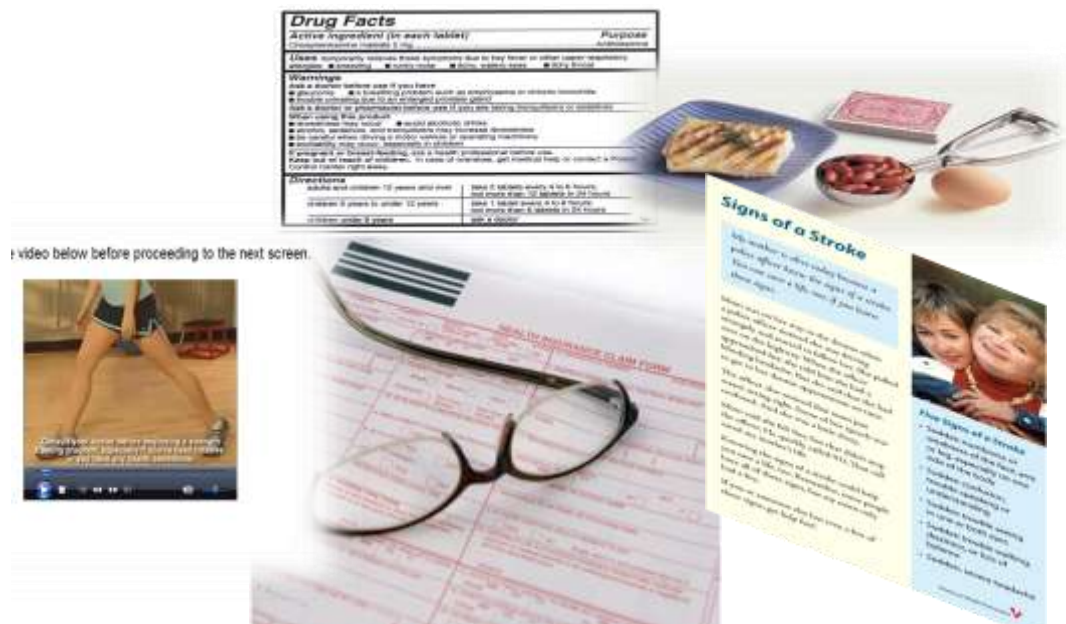# Health Literacy Skills Instrument User Guide

25-Item Instrument (HLSI)

and

10-Item Instrument (HLSI-SF)

RTI International

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User Registration Form and Agreement

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Background

Over the last 20 years, the field of health literacy has grown tremendously. A number of instruments have been used to measure health literacy such as the rapid estimate of adult Literacy in Medicine (REALM) (Davis et al., 1991) and the Test of Functional Health Literacy in Adults (TOFHLA) (Parker, Baker, Williams & Nurss, 1995). These instruments are limited in that they measure reading ability or print literacy, or in the case of the TOFHLA, numeracy; they do not reflect a comprehensive assessment of health literacy (Berkman et al., 2004; IOM, 2009). Instruments also exist that attempt to screen patient health-literacy level in clinical settings (e.g., the Newest Vital Sign; Weiss et al., 2005), measure provider-level facilitation of health literacy (e.g., Consumer Assessment of Health Providers and Systems [CAHPS] Item Set for Addressing Health Literacy; Agency for Healthcare Research and Quality, and assess health literacy using sociodemographic and geographic data elements (Paasche-Orlow, Schillinger, Greene, & Wagner, 2006).

The Department of Education's 2003 National Assessment of Adult Literacy (NAAL) Survey is the only national assessment of literacy that includes some health literacy tasks (Kutner, Greenberg, Jin, & Paulsen, 2006). Of the 28 health literacy tasks on the NAAL, 3 represented a *clinical* domain, 14 represented a *prevention* domain, and 11 items represented *navigation of the health care system*. The NAAL yields estimates of the distribution of levels of health literacy for various population groups. Though it overcomes some of the limitations of other measures, including a focus on assessing skills other than reading, the NAAL has been criticized for its lack of availability, lack of transparency, and challenges in using it (Weiss, 2009).

Based on the IOM's call to action in the report Health Literacy: A Prescription to End Confusion (Nielson-Bohlman, Panzer & Kindig, 2004), RTI International developed a comprehensive, publically available health literacy instrument[1]. This instrument, titled the Health Literacy Skills Instrument (HLSI), measures print literacy, oral literacy, and Internet-based information seeking skills.

Overview of the HLSI

The Health Literacy Skills Instrument (HLSI) was developed to assess 4 domains of health literacy skills: print literacy (reading and writing), numeracy skills, oral literacy skills[2] (listening), and information seeking (navigation of Internet and facilities).

Similar to other measures, the HLSI measures print literacy. However, the HLSI also uses non-print stimuli and examines oral and Internet-based information seeking skills. Stimuli represent health related issues across the life course for health promotion and disease prevention, health care maintenance and treatment, and health system and health information navigation.

The HLSI can be self-administered via a computer, which can reduce data collection costs and minimize potential discomfort or embarrassment among participants. The HLSI is designed to be used in intervention research studies as well as for national and local surveillance.

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[1] This research was funded through grant R01 CA115861-01A2 from the National Cancer Institute.
[2] Note: We conceptualize oral literacy skills as including listening, speaking and negotiating; however, these speaking and negotiating skills are difficult to assess using survey methods. Ideally, these skills would be assessed through observations of interactions between two or more individuals (e.g., a patient and his/her health care provider).

Versions

The original HLSI is comprised of 16 stimuli (educational materials) and 25 questionnaire items. The 10-item HLSI is a shortened version of the 25-item instrument which uses 10 stimuli.

Stimuli

Expert Panel Members (see Appendix A) provided helpful input regarding the definition of health literacy to use, the conceptual underpinnings, and the measurement process. Stimuli selection and type were vetted through a subset of the expert panel members. We requested their input regarding the appropriateness of the proposed stimuli, the health literacy skills each stimuli addressed, and if the collection of stimuli adequately addressed each health domain (e.g., health promotion and disease prevention, health care maintenance and treatment). Panel members also rated the difficulty of the draft survey items, the health literacy skills domain each item assessed, and the overall quality of each item. Items that experts did not feel assessed one or more of the skills domains of health literacy or contributed to a measure of health literacy were eliminated. This review process supported face validity of the stimuli and items selected for the instrument.

The majority of the stimuli are print based. One questionnaire item that assesses oral literacy (listening skills) use an audio stimuli. The weblink to this audio content is provided in the HLSI Questionnaire and is housed on a server at RTI International. Items which assess Internet-based information seeking skills were developed by Healthwise®. RTI International has a Limited License with Healthwise® to allow access to these web-based stimuli for the sole purpose of conducting a health literacy survey. Users cannot use the stimuli for purposes other than conducting a health literacy survey. This content is hosted on Healthwise® servers for the duration of the licensing agreement. Links to these stimuli are also provided in the HLSI Questionnaire.

Three stimuli (Obstructive Sleep Apnea, Lunge and Portion Control) are used with permission from the Mayo Foundation. A fourth stimuli, Food Nutrition Label has also been used with permission, but from a private consultant. The sources and acknowledgement text included with these stimuli must be included when the instrument is used and referenced appropriately.

Survey participants should be cautioned that the educational content within the stimuli should not be substituted for medical advice, and could, in fact be out of date and/or inaccurate.

Administration

Both the 25-item and the 10-item HLSI were designed to be administered using a computer via either in-person or web-based survey data collection. Some questionnaire items that reference print-based stimuli may be able to be administered on a paper-pencil survey or a telephone survey (if stimuli were mailed in advance), but the instrument was not validated using that methodology. Conducting the survey via web allows for the additional assessment of computer-based health information seeking skills which is difficult to measure in a mode other than via the computer.

When deciding upon the mode of data collection for which we should design the HLSI, we considered paper-pencil surveys, telephone surveys, and computer-based data collection. Each mode has advantages and disadvantages. Designing the HLSI for administration via the computer survey allowed us to assess both Internet health information seeking skills and at least one component of oral literacy

(listening skills), which the other modes were less able to accommodate. When selecting a mode of data collection for a survey, population coverage should be considered. Each method presents its own challenges. While not all populations use the Internet, well over the majority of adults in the United States do so.

To establish the reliability and validity of the HLSI, we pilot tested the instrument using KnowledgePanel® created by Knowledge Networks (http://www.knowledgenetworks.com/), an online Non-Volunteer Access Panel (see McCormack et al., 2010 for a full discussion of the methods, sample, and results).

Other Measures
In addition to the health-literacy items, we also administered the short-form of the Test of Functional Health Literacy in Adults (S-TOFHLA) (Wallace, 2006). The TOFHLA and S-TOFHLA are timed reading comprehension tests that use the modified Cloze procedure, in which every 5th to 7th word in a passage is omitted and replaced with a blank space. The patient must select a word to fit into the blank spaces from the 4 multiple-choice options provided for each space. Baker et al. (1999) reported Cronbach's alpha of 0.68 for numeracy and 0.97 for the reading comprehension items of the S-TOFHLA. The overall correlation between the S-TOFHLA and the REALM was 0.80.

We also asked participants to self-report their performance on the kind of skills being assessed in the survey. Specifically, we asked how easy or difficult it is to remember information they read versus hear; how easy or difficult it is to understand information they read versus hear; and how easy or difficult it is to explain a health issue to their doctor, find health information they need, and locate health information on the Web. Responses for each of the seven items included very difficult/difficult/somewhat easy/very easy. Socio-demographic characteristics and selected health-related data on respondents were available from Knowledge Networks.

Suggested Analyses

The HLSI can be used as an independent variable as well as a dependent variable.   Some suggested analyses include:

- examining the variation in socio-demographics, prior knowledge, capabilities, and resources according to the HLSI

- assessing the relationship between health literacy skills and domain-specific and/or general health knowledge.

- conducting path analyses to determine the relationship between health literacy skills and health outcomes, and whether variables such as self-efficacy, attitudes toward specific health behaviors, and skills in making health-related decisions mediate that relationship.

Suggested Uses

The HLSI and the-HLSI-SF both were designed to be used for national and regional surveillance of health literacy skills and to be used to assess interventions designed to increase individuals' health literacy skills.

THE 25-ITEM HEALTH LITERACY SKILLS INSTRUMENT (HLSI)

We conducted psychometric (e.g., Item Response Theory using Multilog software program (Scientific Software International, 2003) and other analyses to assess the reliability and validity of the instrument.

Reliability

The 25-item HLSI demonstrated good internal consistency, with a Cronbach's alpha of 0.86. The higher order confirmatory factor analysis model fit well (CFI=0.95, TLI=0.98, and RMSEA = 0.03). The factor loadings for the four skill-set area factors were as follows: print-prose (0.98), print-document (0.98), print-quantitative (0.95), oral (0.85), and Internet (0.81). Almost all individual items had factor loadings and item-total correlations of 0.40 or higher (McCormack et al., 2010).

Validity

We established face validity of stimuli and items through the expert panel review process prior to pilot testing the instrument. Pilot data was used to assess the construct validity of the HLSI and findings showed that:

- The HLSI was able to discriminate between different subgroups typically considered to have different health literacy skill levels.
- Mean scores on the HLSI were significantly higher among those who reported it was easy to perform specific literacy-related tasks (e.g., understanding information I read; locating health information on the internet) compared to those who reported it was difficult.
- Correlations between the health literacy domains and S-TOFHLA were highest for the print-prose, print-document, and print-quantitative skill areas with correlations of 0.47, 0.45, and 0.41, respectively. The correlations were much lower for the Internet and oral literacy domains, which require fewer reading skills.

These results support the construct validity of the instrument.

Scoring, Cut Points, and Classifications

For each item on the HLSI, there is only one correct response. Correct responses are scored as a 1 and incorrect responses are scored as a 0. The percentage of correct responses per item ranged from 24% to 91%. On average, respondents answered 70% of the items correctly. The most difficult item was #13 which required a mathematical calculation; however it was retained to ensure content validity of the scale by measuring quantitative skills, which are a component of health literacy. The psychometric properties of the 25-item HLSI can be found in Appendix B.

ROC analyses were conducted comparing HLSI scores and respondents' education level and reported difficulty understanding the information they read. Results of these analyses were used to classify participants into three groups: proficient literacy (score >82), basic literacy (score of 70–81), and below basic literacy (score <70) (McCormack et al., 2010). In our sample, 40% of participants have proficient literacy, 22% have basic literacy, and 38% have below basic literacy.

Health Literacy Level	Raw Score	Percent Correct	Percent of Pilot Sample
Proficient	21-25	>82	40
Basic	18-20	70-81	22
Below basic	0-17	<70	38

THE 10-ITEM HLSI-SF

Once the reliability and validity of the 25-item HLSI was established, we developed a short form of the HLSI. To establish the reliability and validity of the HLSI-SF, we used data from the pilot test of the 25-item (see McCormack et al., 2010 for a full discussion of the methods, sample, and results).
Based on the results of the psychometric analyses, we selected the 10 best performing items for inclusion on the brief measure, using the following a priori criteria: (1) Items should have high factor loadings and IRT slopes, indicating good discrimination; (2) To avoid potential floor and ceiling effects, items should not have percentages correct close to 0 or 100%; (3) To ensure the measure encompasses a wide range of ability levels, the items on the scale should have a variety of IRT thresholds and percentage of correct responses, (4) Items with high rates of missing data and/or don't know responses may be confusing and/or irrelevant and will be excluded; and (5) Items should not demonstrate slope-related DIF. In addition to the statistical results, the scale development team also reviewed item wording and selected items to ensure the content validity of the short form by including items that captured each of the 5 components of health literacy (print-prose, print-document, print-quantitative, oral, and internet), as well as other critical health literacy skills while remaining within the 10-item limit.

After identifying the final set of 10 items for the short form, we repeated the confirmatory factor analyses and IRT analyses used to develop the full 25-item HLSI, but used only the items on the short form. We also computed Cronbach's alpha to assess the internal consistency reliability of the short form.
Construct validity was evaluated by conducting analyses of variance to compare mean health literacy short form scores by demographic characteristics and self-reported skills. For comparison purposes, similar analyses were also conducted with the long form scores. Based on earlier results from the long form (McCormack et al., 2010), we hypothesized that participants with higher education levels and those who reported less difficulty with skills related to health literacy would have higher scores on the short form and that the short form would be moderately correlated with the s-TOFHLA.

Items Selected for the HSLI-SF

Ten items were selected for the health literacy short form, covering the following domains from the long form: print-prose (N=2), print-document (N=3), print-quantitative (N=2), internet (N=1), and oral (N=2).

PRINT-PROSE	
Cholesterol	Which set of low density lipoprotein (LDL) and high density lipoprotein (HDL) levels is <u>best</u>?
Stroke	Which of the following is <u>not</u> a sign of a stroke?
PRINT-DOCUMENT	
Hospital map	Which of the following entrance is closest to the elevator?
Medicine record	In the example listed in the first row of the table, when should the medicine be taken?
Portion control	A person is cooking dinner for himself and he wants to include one serving from the meat and beans group. What should he choose?
PRINT-QUANTITATIVE	
Nutrition label	If a person is on a 2,500 calorie diet, what percent of the daily value of saturated fat would he get from one serving?
Prostate cancer graph	More men die from prostate cancer than from other causes. Based on the chart above, would you say this is true, false, or are you not sure?
ORAL	
Telephone recording	If a person was worried about his cough, what number should he press?
INTERNET	
Calories	Kate weighs 150 pounds. Which activity would burn the most calories?
Lunges	What part of the body do lunge exercises work?

Internal Consistency of HLSI-SF

Factor loadings for all items, except item 6 were higher than 0.4. Similarly, all items except item 6 had IRT slopes near or above 1.0, indicating good discrimination. None of the items except item 6 (percentage of saturated fat) demonstrated significant slope or threshold-related DIF by gender, age, race, or education. Item 6 (percentage of saturated fat) was kept because it differentiated those with a high school education or less when compared to those with more than a high school education (i.e. some college or more) and also between white and non-white respondents (see McCormack et al, 2010).

The scale demonstrated acceptable internal consistency reliability with Cronbach's alpha of 0.70. The short form correlated highly with the long form (r=0.90), suggesting minimal loss of information with the use of the short form. The psychometric properties of the HLSI-SF can be found in Appendix C.

Validity of HLSI-SF

Comparisons of health literacy short and long form scores by demographic characteristics are shown in Appendix D. Consistent across both measures, higher health literacy scores were found among those who had higher education and were married and lower scores among those who were black (vs. white) and retired or disabled (vs. employed).   Those who were Hispanic or Other race or unemployed had significantly lower scores on the long form, but not the short form.

As shown in Appendix E, participants with poorer self-reported abilities on a range of health literacy skills had significantly lower scores on both forms of the scale (p < .001). The magnitudes of difference are similar between the two scales as shown by the regression coefficients (B). These skills encompass each of the domains covered by the scale, including print-prose (remembering and understanding information I read), print-document (finding health information I need), print-quantitative (good at math), internet (locating health information on the internet), and oral (remembering and understanding information I hear, explaining a health issue to a doctor) with the strong relationship between the short form and these measures, supporting the construct validity of the short form.

Similar to the 25-item HLSI, the 10-item HLSI (HLSI-SF) had a small to moderate correlation with the s-TOFHLA (r=0.36) as anticipated.

Scoring, Cut Points, and Classifications

The percentage of correct responses for each of the 10 items ranged from 24% of the total sample for item 6 (percentage of saturated fat) to 90% for item 2 (sign of stroke). On average, participants answered 67% (7/10 items) of the items on the short form correctly (SD=23%) compared to 70% (18/25 items) on the long form (SD=22%).

We investigated possible cut-points for classifying participants into three categories based on their health literacy levels: proficient, basic, and below basic, using a similar approach as we used for the long form. We conducted a series of receiver operating characteristic (ROC) analyses to determine which cut-points optimally distinguish participants based on their self-reported difficulty with understanding information they read and their highest level of educational achievement. Using three categories lacked precision, so suggest a cut points to differentiate two categories we have labeled "adequate" and "inadequate" health literacy skills.

Bases on these analyses, we have identified the following cut points: adequate literacy (score 70% and above correct) and inadequate literacy (score of 60% or below correct).

Health Literacy Level	Raw Score	Percent Correct	Percent of Pilot Sample
Adequate	7-10	70-100	63
Inadequate	0-6	<60	37

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Appendix A: Expert Panel Members

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Appendix B. Psychometric Properties of 25 item Health Literacy Items

Content Area/Stimulus	Item	% correct	Item-total correlation	Factor loading	IRT slope	IRT threshold
PRINT-PROSE						
Cholesterol						
	If a person is at high risk for heart disease, which of the following levels of low density lipoprotein (LDL) cholesterol is best?	76	0.44	0.67	1.51	−1.15
	Which set of low density lipoprotein (LDL) and high density lipoprotein (HDL) levels is best?	66	0.49	0.61	1.32	−0.78
Burns						
	Which of the following is probably not a second-degree burn?	67	0.41	0.59	1.20	−0.73
Lactose intolerance						
	Which of the following is a symptom of lactose intolerance?	91	0.36	0.65	1.44	−2.17
Stroke						
	Which of the following is not a sign of a stroke?	90	0.44	0.77	1.92	−1.79
PRINT-DOCUMENT						
Drug side effects label						
	Which of the following problems could be caused by this medicine?	82	0.27	0.48	0.96	−1.86
Hospital map						
	If John was visiting someone in room 130 and wanted to go to the cafeteria, which of these places would he pass if he took the shortest route?	81	0.44	0.68	1.51	−1.50
	Which of the following entrance is closest to the elevator?	80	0.40	0.59	1.22	−1.42
Medicine record						

Content Area/Stimulus	Item	% correct	Item-total correlation	Factor loading	IRT slope	IRT threshold
	In the example listed in the first row of the table, when should the medicine be taken?	59	0.37	0.53	1.00	−0.47
Portion control						
	A person is making a salad and wants to add one serving of chopped, uncooked carrots. How much should she use?	64	0.38	0.43	0.73	−1.10
	A person is cooking dinner for himself and he wants to include one serving from the meat and beans group. What should he choose?	75	0.39	0.65	1.48	−1.07
Insurance EOB						
	How much will the insurance company pay for the physical therapy received on 7/22/09?	53	0.39	0.56	0.98	−0.34
	How much does the patient have to pay for the laboratory services received on 7/15/09?	80	0.44	0.57	1.06	−1.73
PRINT-QUANTITATIVE						
Nutrition label						
	How many grams of fiber are in two servings?	78	0.45	0.72	1.68	−1.22
	If a person is on a 2,500 calorie diet, what percent of the daily value of saturated fat would he get from one serving?	24	0.13	0.34	0.66	2.15
Prostate cancer graph						
	More men die from prostate cancer than from other causes. Based on the chart above, would you say this is true, false, or are you not sure?	80	0.46	0.72	1.64	−1.35
	Based on the chart above, who is more likely to die of prostate cancer?	82	0.42	0.73	1.55	−1.50
ORAL						
Telephone recording						
	If a person was worried about his cough, what number should he press?	58	0.37	0.60	0.96	−0.37

Content Area/Stimulus	Item	% correct	Item-total correlation	Factor loading	IRT slope	IRT threshold
	If a person wanted to check on the date and time of an appointment she already made, what number should she press?	58	0.38	0.57	0.89	−0.48
Sleep apnea						
	What do the muscles in the throat <u>typically</u> do when a person is sleeping?	86	0.40	0.68	1.26	−1.89
Lunges						
	What part of the body do lunge exercises work?	89	0.46	0.94	2.26	−1.76
INTERNET						
Calories						
	John weighs 200 pounds and he walked at a medium pace on a firm surface for 30 minutes. How many calories did he burn?	59	0.52	0.72	1.73	−0.35
	Kate weighs 150 pounds. Which activity would burn the most calories?	54	0.52	0.71	1.75	−0.16
Heart attack risk						
	What does this tool do?	68	0.57	0.87	2.23	−0.71
	John is 39 years old and smokes. His blood pressure is 130/90 and he's on blood pressure medicine. His HDL cholesterol is 50 and his total cholesterol is 230. What is his estimated 10 year risk of a heart attack?	55	0.59	0.90	2.53	−0.25

Note: Factor loadings based on higher-order confirmatory factor analysis with four first-order factors and one second-order factor (CFI=0.95, TLI=0.98, RMSEA=0.03).

Appendix C. Psychometric Properties of 10-Item HLSI-SF

Item	% correct	Factor loading	IRT parameters	
			Slope	Threshold
PRINT-PROSE				
1b) Which set of low density lipoprotein (LDL) and high density lipoprotein (HDL) levels is <u>best</u>?	66	0.57	1.20	-0.88
13a) Which of the following is <u>not </u>a sign of a stroke?	90	0.71	1.84	-1.88
PRINT-DOCUMENT				
8b) Which of the following entrance is closest to the elevator?	80	0.63	1.40	-1.36
9a) In the example listed in the first row of the table, when should the medicine be taken?	59	0.56	1.15	-0.47
14b) A person is cooking dinner for himself and he wants to include one serving from the meat and beans group. What should he choose?	75	0.68	1.59	-1.09
PRINT-QUANTITATIVE				
18c) If a person is on a 2,500 calorie diet, what percent of the daily value of saturated fat would he get from one serving?	24	0.36	0.67	2.06
19a) More men die from prostate cancer than from other causes. Based on the chart above, would you say this is true, false, or are you not sure?	80	0.64	1.62	-1.42
INTERNET				
11b) Kate weighs 150 pounds. Which activity would burn the most calories?	54	0.61	1.36	-0.24
ORAL				
7a) If a person was worried about his cough, what number should he press?	58	0.49	0.91	-0.43
16a) What part of the body do lunge exercises work?	89	0.86	2.46	-1.77

Appendix D. Mean Scores on Long and Short Forms of the HLSI by Demographic Characteristics

Characteristic	N	%	Health Literacy – Long Form			Health Literacy – Short Form		
			Mean (95% CI)	B (SE)	p	Mean (95% CI)	B (SE)	p
Gender								
Male	458	48	70 (68-73)	1.57 (2.18)	.469	67 (64-70)	0.77 (2.26)	.734
Female	431	52	69 (66-72)	REF		67 (63-70)	REF	
Age								
18–29	180	22	69 (65-73)	1.54 (3.08)	.617	67 (62-72)	3.60 (3.32)	.279
30–44	205	25	71 (66-76)	3.53 (3.21)	.271	69 (64-73)	5.14 (3.10)	.098
45–59	255	27	71 (68-75)	4.11 (2.80)	.143	69 (65-72)	5.25 (2.82)	.063
60+	249	26	67 (64-70)	REF		63 (60-66)	REF	
Education								
More than high school	316	36	80 (78-83)	21.49 (2.49)	< .001	78 (75-80)	20.75 (2.63)	< .001
High school graduate	295	33	68 (65-72)	12.13 (2.21)	< .001	65 (61-69)	12.83 (2.38)	< .001
Less than high school	278	31	59 (55-62)	REF		57 (53-61)	REF	
Race								
White	664	64	74 (72-76)	REF		70 (68-73)	REF	
Black	83	13	56 (50-62)	-17.97 (3.47)	< .001	53 (46-60)	-17.37 (3.74)	< .001
Hispanic	80	17	65 (59-71)	-8.73 (3.51)	.013	64 (59-70)	-6.07 (3.42)	.076
Other	62	6	65 (57-72)	-9.06	.038	66 (58-73)	-4.74	.281

			(4.37)				(4.40)	
Marital status								
Married	489	46	73 (71-76)	7.34 (2.12)	< .001	71 (68-73)	6.81 (2.17)	.002
Not married	400	54	66 (63-69)	REF		64 (60-67)	REF	
Employment status								
Employed	470	51	74 (71-77)	REF		70 (67-74)	REF	
Retired	161	15	68 (64-71)	-6.00 (2.54)	.018	64 (61-66)	-6.90 (2.64)	.009
Disabled	81	11	55 (50-59)	-19.23 (4.03)	< .001	52 (47-56)	-18.86 (4.15)	< .001
Unemployed	177	23	68 (64-72)	-5.40 (2.73)	.048	69 (65-72)	-1.79 (2.64)	.499
Geographic region								
Northeast	161	18	67 (62-72)	-3.79 (3.38)	.263	66 (61-70)	-3.43 (3.36)	.308
Midwest	206	22	70 (64-75)	-1.13 (3.44)	.742	66 (60-71)	-3.29 (3.65)	.368
South	338	38	70 (67-73)	-0.57 (2.80)	.838	67 (64-71)	-1.75 (2.87)	.542
West	184	22	71 (66-75)	REF		69 (64-73)	REF	

REF=reference category

Appendix E. Mean Scores on Long and Short Forms of HLSI by Self-Reported Skills

Skill	N	%	Health Literacy – Long Form			Health Literacy – Short Form		
			Mean (95% CI)	B (SE)	p	Mean (95% CI)	B (SE)	p
I am good at math								
Agree	429	46	77 (74-79)	12.59 (2.07)	< .001	74 (71-77)	12.35 (2.16)	< .001
Disagree	450	54	64 (61-67)	REF		62 (58-65)	REF	
Remembering information I read								
Easy	565	65	73 (71-76)	9.93 (2.28)	< .001	71 (68-73)	9.50 (2.32)	< .001
Difficult	317	35	63 (60-67)	REF		61 (58-64)	REF	
Remembering information I hear								
Easy	584	66	72 (70-75)	8.00 (2.42)	.001	70 (67-72)	7.48 (2.40)	.002
Difficult	295	34	64 (61-68)	REF		62 (59-66)	REF	
Understanding information I read								
Easy	665	73	75 (73-77)	18.42 (2.59)	< .001	72 (70-74)	17.08 (2.69)	< .001
Difficult	211	27	57 (52-61)	REF		55 (51-59)	REF	
Understanding information I hear								
Easy	691	77	73 (71-75)	14.89 (2.87)	< .001	71 (69-73)	15.22 (2.94)	< .001
Difficult	189	23	58 (54-63)	REF		56 (51-60)	REF	
Explaining a health issue to my doctor								
Easy	682	74	72 (70-74)	8.87 (2.77)	.001	70 (67-72)	9.62 (2.85)	< .001

Difficult	196	26	63 (59-68)	REF		60 (56-65)	REF	
Locating health information on the internet								
Easy	654	72	74 (71-76)	13.01 (2.57)	< .001	71 (69-73)	13.33 (2.73)	< .001
Difficult	222	28	61 (56-65)	REF		58 (53-62)	REF	
Finding health information I need								
Easy	645	72	73 (71-75)	11.53 (2.67)	< .001	71 (69-73)	11.78 (2.78)	< .001
Difficult	231	28	62 (57-67)	REF		59 (54-64)	REF	

REF=reference category