CE

1.5 ANCC Contact Hours

Health Literacy, Health Disparities, and Sources of Health Information in U.S. Older Adults

Carolyn Crane Cutilli ▼ Lynn C. Simko ▼ Alison M. Colbert ▼ Ian M. Bennett

BACKGROUND: Low health literacy in older adults has been associated with poor health outcomes (i.e., mortality, decreased physical and cognitive functioning, and less preventive care utilization). Many factors associated with low health literacy are also associated with health disparities. Interaction with healthcare providers and sources of health information are influenced by an individual's health literacy and can impact health outcomes.

PURPOSE: This study examined the relationships between health literacy, sources of health information, and demographic/background characteristics in older adults (aged 65 years and older) related to health literacy and disparities.

METHODS: This descriptive, correlational study is a secondary analysis of the 2003 National Assessment of Adult Literacy, a large-scale national assessment.

RESULTS: Older adults with lower health literacy have less income and education, rate their health as poor or fair, have visual or auditory difficulties, need help filling out forms, reading newspaper, or writing notes, and use each source of health information less (print and nonprint). Many of these characteristics and skills are predictive of health literacy and associated with health disparities.

CONCLUSION: The results expand our knowledge of characteristics associated with health literacy and sources of health information used by older adults. Interventions to improve health outcomes including health disparities can focus on recognizing and meeting the health literacy demands of older adults.

Introduction

Older adults in our country are at risk for suboptimal health due to their high rate of low health literacy. Fifty-nine percent of older adults have low health literacy. Research in the older adult population has shown that low health literacy is associated with increased mortality, worse physical functioning and mental health, fair/poor rating of health, heart failure health outcomes, less preventive care and health-promoting behaviors (Baker et al., 2007; Bostock & Steptoe, 2012; Chen, Hsu, Tung, & Pan, 2013; Kobayashi, Wardle, Wolf, & von Wagner, 2015; Mahnoush et al., 2015; Mottus et al., 2014; Smith et al., 2015; White, 2008), more difficulty with activities of daily living and activity limitations (Wolf, Gazmararian, & Baker, 2005), and more rapid decline in executive function (Sequeira et al., 2013). Health literacy has been found to be a mediator for health outcomes in older adults with heart failure (Wu, Moser, DeWalt, Rayens, & Dracup, 2016).

Many public and private organizations have made health literacy a priority and invested resources to help educate healthcare providers, including the American Medical Association (n.d.), Institute of Medicine (Nielsen-Bohlman, Panzer, & Kindig, 2004), The Joint Commission (n.d.), Pfizer (2015), and Agency for Healthcare Research and Quality (2010). The Centers for Disease Control and Prevention (2014) emphasizes the importance of older adults having adequate health literacy to address health concerns often associated with aging. Health literacy as a national priority is also demonstrated by its inclusion in Healthy People 2020 and the 2003 National Assessment of Adult Literacy (NAAL).

The NAAL is a national assessment that examined the relationship between literacy/health literacy and background characteristics in a representable sample of the U.S. population. Several characteristics examined in the NAAL have been identified as variables associated with health disparities (e.g., disability, racial/ethnic group, geography, socioeconomic status) (Healthy People 2020, n.d.). The NAAL provides the opportunity to use a large-scale national assessment to examine

Carolyn Crane Cutilli, PhD, RN, Patient and Family Education Specialist, Hospital of the University of Pennsylvania, Philadelphia; and Adjunct Professor, Master's Degree Program, American International College, Maple Glen, PA.

Lynn C. Simko, PhD, RN, CCRN, Clinical Associate Professor, School of Nursing, Duquesne University, Pittsburgh, PA.

Alison M. Colbert, PhD, PHCNS-BC, Associate Professor and Associate Dean for Academic Affairs, School of Nursing, Duquesne University, Pittsburgh, PA.

Ian M. Bennett, MD, PhD, Department of Family Medicine, Family Medicine Research Section, University of Washington School of Medicine, Seattle.

No conflicts of interest or sources of funding for the authors.

DOI: 10.1097/NOR.0000000000000418

possible relationships between health literacy and disparities in older adults. For the overall adult population, lower income and education are associated with lower health literacy (Kutner, Greenberg, Jin, & Paulsen, 2006; White, 2008).

Although insight into disparities related to health literacy is critical, it is equally important to understand how those relationships then translate into specific health behaviors, such as health information seeking and interactions with providers. Reaching patients with information they deem useful is an important foundational step in self-management. The literature notes that older individuals with inadequate health literacy and chronic illnesses (asthma, diabetes, and congestive heart failure) have lower mean knowledge scores about their chronic condition compared with those with adequate health literacy (Gazmararian, Williams, Peel, & Baker, 2003). Thus, we need to find a way to support knowledge acquisition in this group. A first step is understanding where older adults access health information.

As expected, the NAAL showed that the largest percentage of all adults with *below basic* health literacy used each source of printed health information less (newspaper, magazine, books, Internet) compared with others with higher health literacy. Although participants with low health literacy used each nonprint source (radio/TV, family/friends/coworkers, and doctor/healthcare provider) more than print sources, they still had the highest percentage of adults who did not use each nonprint source (Kutner et al., 2006). It is interesting to note that the percentage of those who use doctor/healthcare providers "a lot" decreases as health literacy decreases.

Current research on sources of health information (health information-seeking behavior) is heavily focused on Internet usage. The Program for the International Assessment of Adult Competencies (PIAAC) showed that adults with a high school diploma used more text-based sources compared with those without a diploma (Feinberg et al., 2016). In the NAAL, the average health literacy scores were highest for adults who sought health information from the Internet (White, 2008). The literature suggests that older individuals use the Internet less than younger persons but the gap is closing (Kontos, Blake, Chou, & Prestin, 2014; Levy, Janke, & Langa, 2014; Pew Research Center, n.d.; Tennant et al., 2015). Other studies note that for older adults, the physician is a main source of health information (Campbell & Nolfi, 2005; Hall, Bernhardt, & Dodd, 2015; Morey, 2007). The NAAL data provide the opportunity to examine the sources of health information used by older adults on a national level for strategy and policy development to impact health outcomes. Healthcare providers need to provide education where older adults are seeking it, especially those with low health literacy and at risk for health disparities.

This descriptive, correlational study is a secondary analysis using data from the 2003 NAAL to examine the relationships between health literacy, demographic/background characteristics of older adults (aged 65 years and older), and sources of health information. The conceptual model for this study, "Causal Pathways Between Limited Health Literacy and Health Outcomes" (Paasche-Orlow & Wolf, 2007), directed the selection of variables and allowed for further exploration of the relationships posited. Specifically, the model suggests that an individual's health outcome is affected by access and utilization of healthcare, provider–patient interaction, and self-care, all of which are influenced by health literacy level and key demographic variables. Self-care is conceptualized in the model as patients' knowledge/skills and extrinsic factor such as health education. For this study, self-care is operationalized within the context of health information and seeking: knowledge/skills (use of the Internet and e-mail, understanding medication dosing, help needed with completing tasks such as writing notes, mathematics, reading newspaper) and health education (newspapers, magazines, books, TV/Radio, family, friends and coworkers, and healthcare professionals). Using the model as a guide, this study sought to further explore how health literacy level and key demographic variables directly tied to health disparities are related to information-seeking self-care.

The research questions for this study are as follows:

1. What sociodemographic (educational attainment, income, race, region of the country, gender, marital status, U.S. citizenship, country of birth), background (computer usage, cognitive tasks, language, health status, vision, hearing, disabilities), and extent of health information use (sources of health information) variables are associated with older adults' health literacy?
2. What variables related to health literacy, health disparities, and sources of health information are related to the health literacy levels of older adults?

Methods

The 2003 NAAL was implemented through the U.S. Department of Education, Institute of Educational Sciences, National Center for Education Statistics (NCES). This large-scale national assessment was designed to provide an estimation of literacy and health literacy for U.S. populations such as older adults. To decrease the burden on individual participants, a fraction, rather than all, of the assessment items were administered to each participant, resulting in no accurate individual score. The NCES used marginal maximum likelihood models to estimate health literacy scores for populations. AM software was developed to provide these estimates (NCES, n.d.-b)

The health literacy measurement included 28 health literacy questions embedded in the literacy tasks (White, 2008). The NAAL examined health literacy in relationship to various background demographics/characteristics. Specifically, the questions focus on functional health literacy tasks centered on the following domains: clinical (medications, diagnosis, and treatment), preventative (self-care, preventing disease), and health system navigation (informed consent, health insurance coverage) (Kutner et al., 2006). The population's health literacy (prose, document, and quantitative tasks) was categorized on the basis of mean health literacy score: *below basic* (0–184), *basic* (185–225), *intermediate* (226–309), and *proficient* (310–500) (White &

Dillow, 2005). These categories were developed by a committee using the Bookmark method and "quasi-contrasting groups approach" (Baldi, 2009).

Sample

This study included 2,668 nonincarcerated older adults (aged 65 years and older) who were part of the 18,000-person household sample from the NAAL study. The household sample was determined through a four-stage, stratified area sample: primary sampling units of counties or groups of contiguous counties, secondary sampling units (segments) of area blocks, housing units with households, and finally eligible persons in households. This sample was weighted to represent the total U.S. population. The participant's assessment was considered complete and included if the background questionnaire and at least one task from each of the three scales were answered.

For individuals who completed the questionnaire but failed to answer any literacy tasks, regression-based imputation methods were used (Greenberg & Jin, 2007). The imputation procedure was instituted to avoid nonrandom unknown biases due to refusal. The analysis concluded that nonresponsive bias was negligible at the screening and background questionnaire stages (Kutner et al., 2006). Participation in the NAAL was strictly voluntary.

Data Collection

The assessment was administered on a one-on-one situation using a computer-assisted personal interviewing system. Participants utilized everyday aids and other tools such as eyeglasses, magnifying glasses, rulers, and calculators when completing tasks. The assessment began with the 35-minute questionnaire on background information, followed by seven core literacy tasks (Kutner et al., 2006). Topics in the background questionnaire include political and social participation, labor force participation, literacy practices, job training and skills, family literacy, and areas described in the research questions.

The ability of the subjects to participate in the main assessment was determined by completion of seven initial tasks. Those who struggled with these tasks were given an alternate assessment designed to present easier tasks first and move onto highly contextualized material usually found at home or in the community. The NAAL consisted of 152 tasks divided into 13 blocks, with approximately 11 questions per block. Each participant was given a booklet with three blocks of questions. Health literacy assessment questions were embedded in the assessment (Kutner et al., 2006).

For this secondary analysis, the data were accessed through the public-use file "NAAL_2003_Health.am" (NCES, n.d.-b) located on the NCES' NAAL website (NCES, n.d.-a). In this large database, missing data were managed during the data collection process. To compensate for missing data and avoid bias from the participant's refusal to answer, this study used imputed answers. Imputed answers are based on the answers given by participants with the same background characteristics.

Variables

Thirty-two variables from the 2003 NAAL were chosen for this study. In this study, health literacy was the dependent variable and the sociodemographic and background variables were independent variables. Variables were selected on the basis of their identification in the literature on health literacy, health disparities, and sources of health information (health information-seeking behavior). The variables examined include gender, educational attainment, race, income, marital status, region, U.S. citizenship, country of birth, vision, hearing, language, disabilities, help with tasks, and sources of health information (Cutilli, 2010; Healthy People 2020, n.d.; Kutner et al., 2006; Paasche-Orlow & Wolf, 2007). Because the study was a secondary analysis, some variables did not produce usable data due to erroneous outcomes or error messages. These variables are citizenship, country of birth, language, and needing help with mathematics.

Statistical Analyses

The data were opened in the AM software for data editing and statistical analyses. A data filter was set for the age 65 years or older. Data editing such as removing nonapplicable values and collapsing categories was completed as needed. Descriptive statistics include frequencies and measures of central tendency. To answer the first research question, bivariate analyses using independent *t* tests with Bonferroni adjustments as needed were conducted to explore the relationships of health literacy with sociodemographic and background characteristics associated with health literacy, health disparities risk factors, and sources of health information.

To assist with the clinical interpretation of the differences, effects sizes were reported for the difference in health literacy for each variable. An effect size is considered to be the smallest immediate difference that is clinically meaningful in the target population for the outcome of interest (i.e., health literacy in this study). Reporting the differences between the groups using an effect size index provides a more accurate interpretation of the clinical significance of results. As per Cohen (1992), the difference between two group mean scores falls under the index Cohen's *d*. Accordingly, an effect size of 0.20 is considered a small effect, 0.50 is considered a medium effect, and 0.80 is considered a large effect. Medium and large effects are considered substantial and of practical importance.

Finally, to answer the second research question, a simultaneous multiple linear regression was conducted to determine the predictive relationships of study variables on health literacy. The selection of variables for regression was based on outcomes of the bivariate analyses. For inclusion, the variable had to have at least half of the categories in the bivariate analyses demonstrate significance. The AM software allowed for the testing of the overall model but did not provide a measure of the robustness of the model through the quantification of the variance explained. In addition, although the AM software is able to test the contribution of each predictor

to the overall model, it is unable to quantify the differences within each level of the predictor.

Results

Participants

The 2,668 participants of this study represent older adults in the United States. Table 1 describes demographic characteristics of the sample population. The majority of participants were female, white, married, having some high school education or were high school graduate, and earned above $40,000 per year. The mean health literacy score for older adults was 214 (translating to *basic* level), with 59% of the population having *below basic* or *basic* health literacy.

Sociodemographic Characteristics

There was no difference between genders, with the mean health literacy score in both males (214, 2.3) and females (214, 3.4) at the *basic* level. Mean health literacy scores were at the *basic* level (217, 2.2) for White/Hispanic category and *below basic* (182, 6.25) for Black and Other (including multiracial) category, with a significant difference demonstrating medium effect size.

Table 1. Sociodemographic Characteristics of the Participants

Variable	Categories	%
Gender	Female	55
Race/ethnicity	White	85
	Black	7
	Hispanic	5
	Other	3
Region	South	37
	Midwest	24
	Northeast	20
	West	19
Marital status	Married/living as married	59
	Separated, divorced, or widowed	37
	Never married	4
Education	Some high school/high school graduate/GED	63
	Vocational school or some college	20
	College graduate/graduate school	17
Household income	Above $40,000	69
	Below $40,000	31
	Difficulty hearing	25
	Learning disability	1
Health literacy level	*Below basic*	29
	Basic health	30
	Intermediate	38
	Proficient	3

The variables related to U.S. citizenship, country of birth, and language usage could not be used because of erroneous data or error messages.

The variables in Table 2 demonstrated statistically significant differences between mean health literacy scores of categories within the variable. For income, as anticipated, the mean health literacy score increased as the income increased; however, the mean score remained relatively constant for income greater than $60,000. The significant differences in health literacy occurred most frequently between the lowest income level and all others, with medium to large effect sizes for almost all. Health literacy increased with educational attainment, demonstrating statistical differences between most categories with medium to large effect sizes.

Background Characteristics

Knowledge/Skills

Table 2 shows the results for help with forms, reading a newspaper, and writing notes. The health literacy level declined as the need for help increased. The most differences between mean health literacy scores were statistically different with medium to large effect sizes. The older adult population that needed the most help had an average score in the *below basic* range (162–181). Even those who did not need help had *basic* health literacy (221–225). Erroneous data or error messages prevented the use of variables related to understanding medication dosing and obtaining help with mathematics.

Health

Variables related to health such as vision, hearing, and overall health are given in Table 2. The mean health literacy scores for those who answered "yes" to vision (190) and hearing (203) difficulties were at the *basic* level and statistically different from the scores of those who did not ($p < .05$). The effect size was medium and small, respectively. For self-reported overall health, the mean health literacy score increased with improving health. Significance differences were found for fair/poor health compared with good to excellent health, with effect sizes ranging from small to large.

Health Education (Sources of Health Information)

The results of the association between health literacy and health education (sources of health information) are shown in Tables 3 and 4. Table 3 presents mean health literacy scores/standard errors associated with frequency (a lot, some, a little, and none) for each source of health information. This includes results of bivariate comparisons with indication of statistical significance and effect size. Table 4 shows the percentage of older adults associated with frequency, source of health information, and health literacy level.

Tables 3 and 4 show that overall health literacy decreases as the use of each sources of health information decreases. In Table 3, approximately half of the scores were basic (192–226) and the lowest mean health literacy scores were associated with utilizing each source of health literacy "none." Use of the Internet at all

Table 2. Comparison of Health Literacy Mean Scores by Education, Income, Help With Tasks, and Health (Vision, Hearing, and Overall) Effect Sizes Reported Only for Significant Differences

Variable	Health Literacy Mean	*SE*	Effect Sizes for Pairwise Comparisons[a]					
Household income			**2**	**3**	**4**	**5**	**6**	**7**
1. $0–$14,999	183.0	4.1	0.4	0.5	0.7	0.8	1.3	1.1
2. $15,000–$19,999	201.6	4.1		NS	NS	0.6	1.2	1.0
3. $20,000–$29,999	212.3	4.7			NS	NS	0.7	NS
4. $30,000–$39,999	219.2	5.2				NS	0.8	NS
5. $40,000–$59,999	227.3	5.0					NS	NS
6. $60,000–$99,999	252.6	6.7						NS
7. $100,000+	241.3	11.9						
Bonferroni adjusted $\alpha = .00244$								
Education			**2**	**3**	**4**	**5**		
1. Still in high school/less than/ some high school	167.2	4.8	0.5	1.0	1.1	1.5		
2. GED/high school equivalency	194.5	7.2		NS	0.7	1.2		
3. High school graduate	216.1	2.8			NS	0.8		
4. Vocational/some college/ associate degree	224.5	3.7				0.6		
5. College+	250.7	4.8						
Bonferroni adjusted $\alpha = .005$								
Overall health			**2**	**3**	**4**	**5**		
1. Excellent	231.2	6.4	NS	NS	0.8	0.9		
2. Very good	231.7	4.0		0.4	0.8	1.0		
3. Good	212.9	3.2			0.4	0.7		
4. Fair	191.6	3.8				NS		
5. Poor	179.0	8.7						
Bonferroni adjusted $\alpha = .005$								
Get help with forms			**2**	**3**	**4**			
1. A lot	162.6	5.9	0.7	1.0	1.3			
2. Some	203.4	6.2		NS	0.4			
3. A little	216.5	4.1			NS			
4. None	225.3	2.4						
Bonferroni adjusted $\alpha = .008$								
Help with writing			**2**	**3**				
1. A lot/some	175.2	6.6	0.4	0.9				
2. A little	201.0	6.2		0.4				
3. None	220.8	2.2						
Bonferroni adjusted $\alpha = .017$								
Help with newspaper								
1. A lot, some, a little	181.3	4.8	0.8					
2. None	223.1	2.0						
Difficultly seeing								
1. Yes	189.8	5.2	0.5					
2. No	218.6	2.1						
Difficulty hearing								
1. Yes	203.3	4.3	0.3					
2. No	217.1	2.2						

Note. NS = not significant.
[a]Effect sizes reported only for comparisons significant at Bonferroni adjusted α or $p < .05$ for *t*-test results.

Table 3. Sources of Health Information Variables With Mean Health Literacy Scores, Comparisons, and Effect Sizes

Variable	Mean	*SE*	Effect Sizes for Pairwise Comparisons[a]		
Receive health issue information from newspapers			**2**	**3**	**4**
1. A lot	227.2	4.9	NS	0.4	0.8
2. Some	221.8	2.7		0.3	0.7
3. A little	207.8	3.8			0.4
4. None	182.4	5.7			
Bonferroni adjusted $\alpha = .008$					
Receive health issue information from magazines			**2**	**3**	**4**
1. A lot	223.0	3.6	NS	NS	1.1
2. Some	226.6	2.6		NS	1.1
3. A little	212.6	4.6			1.1
4. None	171.5	4.5			
Bonferroni adjusted $\alpha = .008$					
Receive health issue information from the Internet			**2**	**3**	**4**
1. A lot	235.4	6.1	NS	NS	0.6
2. Some	249.9	5.1		NS	0.9
3. A little	249.1	7.5			0.9
4. None	203.1	2.2			
Bonferroni adjusted $\alpha = .008$					
Receive health issue information from radio/TV			**2**	**3**	**4**
1. A lot	204.3	3.5	0.3	0.3	NS
2. Some	219.1	2.7		NS	0.6
3. A little	222.9	4.7			0.5
4. None	191.5	7.0			
Bonferroni adjusted $\alpha = .008$					
Receive health issue information from books			**2**	**3**	**4**
1. A lot	228.3	4.3	NS	NS	1.1
2. Some	222.9	2.3		NS	1.1
3. A little	216.6	4.0			0.8
4. None	171.5	5.1			
Bonferroni adjusted $\alpha = .008$					
Receive health issue information from family members or friends or coworkers			**2**	**3**	**4**
1. A lot	209.2	5.1	NS	NS	NS
2. Some	218.8	3.0		NS	0.4
3. A little	221.5	4.5			0.5
4. None	197.0	3.4			
Bonferroni adjusted $\alpha = .008$					
Receive health information from doctors/ healthcare providers			**2**	**3**	**4**
1. A lot	216.1	2.3	NS	NS	0.7
2. Some	218.0	3.0		NS	0.8
3. A little	212.8	5.8			0.6
4. None	177.6	6.6			
Bonferroni adjusted $\alpha = .008$					

Note. NS = not significant.
[a]Effect sizes reported only for comparisons significant at the Bonferroni adjusted α.

Table 4. Participants' (Percentage) Use of Sources of Health Information by Health Literacy Level

Sources of Health Information	A Lot (%)	Some (%)	A Little (%)	None (%)
***Belowbasic* (0–184)**				
Newspaper	12	30	26	32
Magazine	9	27	21	42
Books	10	28	21	41
Internet	2	2	3	93
Radio/TV	30	35	20	15
Family/friends/coworkers	17	34	22	27
Doctor/healthcare Providers	41	29	18	12
***Basic* (185–225)**				
Newspaper	22	39	23	16
Magazine	9	30	21	42
Books	17	45	21	17
Internet	5	8	6	81
Radio/TV	27	46	20	7
Family/friends/coworkers	14	39	26	21
Doctor/healthcare providers	43	38	14	5
***Intermediate* (226–309)**				
Newspaper	26	43	20	11
Magazine	21	50	20	9
Books	20	48	23	9
Internet	8	17	10	65
Radio/TV	21	47	25	7
Family/friends/coworkers	15	41	30	14
Doctor/healthcare providers	43	38	15	4
***Proficient* (≥310)**				
Newspaper	23	43	23	11
Magazine	7	59	29	5
Books	27	34	34	5
Internet	4	26	29	41
Radio/TV	14	33	46	7
Family/friends/coworkers	18	42	35	5
Doctor/healthcare providers	47	22	29	2

frequency levels was associated with *intermediate* health literacy. Also, the use of print materials was associated with higher mean health literacy levels. Most significant differences exist between print and nonprint sources, as well as those who use sources "none" compared with other levels of frequency. The effect sizes ranged from small to large (0.3 to 1.1), with some of the greatest effect sizes noted for print sources.

Table 4 shows that a larger percentage of older adults with lower health literacy use each nonprint source less than those with higher health literacy. A very large percentage (41%–93%) of older adults do not use the Internet as a source of health information. The healthcare provider is used "a lot" by 41%–47% of older adults regardless of health literacy level. Besides the healthcare provider, the TV/radio is the next most frequent source of health information used by most older adults (85%–93%).

Regression

From the original 32 variables, 15 were placed into the regression analysis to determine which are statistically significant ($p < .05$) and have the greatest impact on the mean health literacy scores (see Table 5). The results reveal that the overall regression model was a statistically significant estimator of health literacy and impact of a specific variable on health literacy through the unstandardized beta coefficient (β). The coefficient can be positive or negative depending on the assigned value of categories within the variables. The following variables were significant (estimate in the parentheses): household income (4.284); educational attainment (9.249);

Table 5. Regression Analysis Showing Contribution of Individual Predictors to the Overall Prediction Model

Predictors	β	*SE*	*t* Statistic	*p*
Constant	219.522	17.479	12.559	.001*
Race/ethnicity	−8.247	4.137	−1.994	.051
Approximate household income (eight categories)	4.284	1.004	4.266	.001*
Educational attainment (six categories)	9.249	1.531	6.039	.001*
Difficultly seeing words and letters in newspapers even with glass/lenses	2.709	4.038	0.671	.505
Difficulty hearing in normal conversation even with hearing aid	−2.496	4.316	−0.578	.565
Get help from family/friends filling out forms	6.213	2.098	2.962	.004*
Get help from family/friends to read newspaper articles	13.623	4.561	2.987	.004*
Get help from family/friends to write notes	5.387	2.855	1.887	.064
Overall health	−5.698	1.694	−3.364	.001*
Receive health information from doctors/healthcare providers	−5.228	1.942	−2.691	.009*
Receive health issue information from books	−5.982	2.32	−2.578	.012*
Receive health issue information from the Internet	−5.231	2.272	−2.303	.025*
Receive health issue information from magazines	−5.552	2.177	−2.55	.013*
Receive health issue information from newspapers	−3.663	2.093	−1.751	.085
Receive health issue information from radio/TV	2.21	1.924	1.149	.255
Root MSE	41.922	1.731	–	–

*$p < .05$.

get help filling out forms (6.213) and reading newspaper articles (13.623); overall health (−5.698); and receive health information from doctors/healthcare providers (−5.228), books (−5.982), Internet (−5.231), and magazines (−5.552).

Discussion

This secondary analysis of the NAAL was a unique opportunity to examine relationships between health literacy and demographic/background characteristics in the U.S. older adult population. This study has three key findings: (1) Results support most relationships described in the conceptual model and literature associated with health literacy and help identify potential ways to impact health disparities through health literacy interventions. (2) There are similarities and difference in the utilization of health information sources based on health literacy level. (3) The results support established health literacy predictive relationships and identify variables (knowledge/skills, health education) that make the model more robust.

For the first research question, the results demonstrate that most relationships in the conceptual model/literature between background variables and health literacy exist in the older adult population. Furthermore, the results show that several, although not all, of the variables related to health literacy and health disparities may have potential to impact health outcomes in older adults. In the health disparities literature, gender is identified as a variable that impacts health conditions/outcomes. However, the results did not demonstrate a difference between mean health literacy scores and gender in this study. Thus, health disparities related to gender will most likely not be resolved through health literacy interventions.

In contrast, the literature on health literacy and health disparities repeatedly demonstrates that those from lower income brackets and lower educational attainment have lower health literacy and experience health disparities. This study showed that there were significant differences in the mean health literacy score between the lowest income level/lowest educational level and most other income/educational levels. Interventions such as additional support for health management in communities with lower income and education may help older adults take care of their health and potentially prevent health disparities.

A strong relationship between health and health literacy was demonstrated through self-reported overall health. This is consistent with the literature noting that older adults with lower health literacy had worse health status (Baker et al., 2002; Baker, Gazmararian, Sudano, & Patterson, 2000; Mottus et al., 2014; Sudore et al., 2006; Wolf et al., 2005). Although vision and hearing deficits were not significant in predicting health literacy when compared with the other variables in the regression model, the significant differences noted between the mean health literacy score of those with these disabilities are important to consider when developing interventions to decrease disparities in this population.

The first research question is also answered by examining sources of health information and health literacy. The sources used by older adults vary on the basis of

health literacy level, although there are some similarities. Most recent studies on sources of health information or health information-seeking behaviors have focused on using the Internet. Older adults using the Internet have higher education, incomes, and health literacy and make better healthcare decisions (James, Boyle, Yu, & Bennett, 2013; Kobayashi, Wardle, & von Wagner, 2015; Pew Research Center, n.d.). Studies show that older adults did not rely on the Internet for information and have healthcare providers as the main source of information (Gollop, 1997; Kutner et al., 2006; Morey, 2007; Tian & Robinson, 2008). The results of this study support findings in the literature. The implication for healthcare providers is to understand that older adults do not use the Internet to the same extent as other segments of the population and it may not be the preferred source of health information.

For the remaining sources of health information, the results of this study support the literature stating that the percentage of adults using each source increases with increasing health literacy (Kutner et al., 2006). However, the extent to which the source is used varies when comparing the general adult population and older adults. For example, the percentage of older adults who use doctor/healthcare provider "a lot" increases with increasing health literacy whereas for the general adult population, the percentage decreases with increasing health literacy. Thus, older adults use healthcare providers differently than do other adults and interventions should be tailored to address this difference. It is imperative that providers make health education a priority and be prepared to be the main source of health information for older adults. Providers need to adjust their strategy to educate older adults on the basis of health literacy level, reaching out to those with the lowest health literacy (because they seek health information the least) and being prepared to direct those with higher health literacy to various reputable sources.

As the fee-for-service model of healthcare finance is replaced by fee based on quality, providers have an opportunity to change their approach to patient and family education. Providers can try methods that engage patients and provide education in a way that meets the patients' health literacy needs. This process is actually less difficult if providers follow the principles of Universal Health Literacy Precautions (Agency for Healthcare Research and Quality, 2010), educating all older adults with using simple, everyday language. Because lower health literacy has been associated with decreasing cognitive ability, providing education that decreases the load on cognition is essential (Gakumo, Enah, Vance, Sahinoglu, & Raper, 2015; Kobayashi, Wardle, & von Wagner, 2015; Kobayashi, Wardle, Wolf et al., 2015; Mottus et al., 2014; O'Conor et al., 2015; Tennant et al., 2015).

TV/radio is the next most used source of health information for older adults of all health literacy levels. The popularity of shows such as *Dr. Oz*, the inclusion of the health reports on local and national news broadcasts, and the popularity of health stations on satellite radio demonstrate the desire to receive health information via this medium. Healthcare providers must push for more health information to be made available through TV and radio and be available to provide information when needed for these sources. New electronic sources (Internet, cable), which provide on-demand content to various devices such as laptops and tablets, are another method to present information in a format similar to TV and radio. New technology will require healthcare providers to partner with older adults and technology specialists to develop access to these devices while decreasing the load on cognition.

On the whole, print health sources were used by a lower percentage of older adults when compared with nonprint sources with one notable exception. Families/friends/coworkers were used less often than some forms of print resources for older adults with *basic* and *intermediate* health literacy. More research to understand the context in which family/friends/coworkers are used by older adults would help identify potential strategies. Also to meet the educational needs of older adults with lower health literacy, the following interventions should be examined: Increasing provider time for more extensive education and/or having health educators working with the provider answer questions and supply additional education during the office visit. Because resources are finite, prioritizing interventions using the most common nonprint sources is very important.

The second research question is addressed by the examination of variables in the regression analysis. On the basis of the conceptual model, two (income and education) of the nine significant predictors of health literacy have been identified as impacting health literacy. The other significant predictors have not been discussed in the literature. This study identified self-care variables related to patients' knowledge/skills (help with forms and reading newspaper) and health education (sources of health information) as impacting health literacy. The literature on predicting health literacy using patients' skills has focused on using single questions related to ability or confidence to complete tasks. These studies demonstrated that the use of screening questions is as effective as other more lengthy health literacy assessments such as the Rapid Estimate of Adult Literacy in Medicine (REALM) or the Test of Functional Health Literacy in Adults (TOFHLA) (Wallston et al., 2014). For example, Chew, Bradley, and Boyko (2004, p. 588) used the following questions to determine adequacy of health literacy: "How often do you have someone help you read hospital materials?" Like this question, the NAAL questions about knowledge/skills could provide the foundational work to pursue additional single-question screening tools used to identify those with low health literacy.

Where patients seek health information has not been cited as a variable that predicts health literacy. In this study, four sources of information (doctors/healthcare providers, books, Internet, and magazines) were found to be statistically significant in the regression analysis. Thus, use (or lack of use) of these sources may have potential to predict health literacy. When educating older adults, providers should ask about the sources of health information used to help the provider understand patients' health literacy levels and direct patients to reliable information they are more likely to use.

Limitations

This study is limited by being a secondary analysis. The principal investigator did not have control over the original research questions and data collection. As a result, the analysis of data was limited by an insufficient number of observations and thus several variables (i.e., language, citizenship) could not be examined. To increase observations, categories of variables were collapsed (i.e., race, help with reading newspaper). By collapsing White and Hispanic into one category, any discussion about race in the U.S. older adult population is limited by the lack of meaningful analysis. This may have also contributed to race not being significant in the regression analysis. The variable "help with reading" was also collapsed into "help" versus "no help." This may have impacted the estimate in the regression analysis because it was substantially higher than other variables' estimates. Although the NAAL is the only large-scale national study of health literacy in the United States, the data from the study are more than 10 years old. Thus, the data do not reflect changes in the population such as technology skills and the increase or decline in the use of certain sources of health information such as the Internet and newspapers.

Conclusion

This secondary analysis examined health literacy and multiple background questions in the U.S. older adult population using the NAAL data. The results support most relationships described in the conceptual model and literature associated with health literacy and as a result have potential to impact health disparities through health literacy interventions. These results also demonstrate the similarities and difference in the utilization of health information sources based on health literacy level, support established health literacy predictive relationships, and identify variables (skills, knowledge) that make the model more robust.

The results confirm relationships already established in the literature between sociodemographic variables and health literacy. Lower health literacy in older adults is associated with income less than $15,000 (in 2003), high school graduate or less, vision and hearing deficits, and fair/poor overall health. Income and education were the strongest predictors of health literacy when compared with other variables. Because these characteristics are also associated with health disparities, the potential role of health literacy in the decreasing disparities needs to be examined. Interventions (e.g., community health workers, postdischarge phone calls) focused on older adults with these characteristics may impact their ability to manage their health and could potentially lessen disparities. Rubin et al. (2014) developed a program to train volunteers for Meals on Wheels as health literacy coaches for older adults.

Knowledge/skills and health education variables under self-care (needing help with skills such as filling out forms, reading newspaper, and writing notes; and sources of health information) have an interactive relationship with health literacy. Knowledge/skills/health education variables not only were utilized by older adults but can also be indicators of health literacy. In this study, the first two knowledge/skills listed earlier were identified as predictive and thus have the foundational potential to be used as single-item screener questions and make the conceptual model more robust.

Sources of health information results demonstrated some similarities and differences by health literacy level. They showed that the opportunity to educate older adult patients, regardless of health literacy level, is during the interaction with the doctor/healthcare provider and the Internet is not the preferred source. Results also show that as health literacy decreases, the percentage of older adults using each source of health information decreases. Thus, those with lower health literacy may need the healthcare system to reach out and engage them in learning about health concerns rather than assuming they will use nonprint sources. Future research should be focused on interventions that engage older adults while supplying education in formats most commonly used such as the healthcare provider and TV/radio. Some sources of health information (print and nonprint materials) used by older adults are predictive of health literacy. They may provide the foundation for determining additional single-item screeners for identifying those with low health literacy and make the conceptual model more robust.

References

Agency for Healthcare Research and Quality. (2010). *Health literacy universal precautions toolkit*. Retrieved from http://www.ahrq.gov/qual/literacy/

American Medical Association. (n.d.). *Health literacy kit*. Retrieved from http://www.ama-assn.org/ama/pub/about-ama/ama-foundation/our-programs/public-health/health-literacy-program/health-literacy-kit.page?

Baker, D., Gazmararian, J. A., Sudano, J., & Patterson, M. (2000). The association between age and health literacy among elderly persons. *Journals of Gerontology Series B-Psychological Sciences & Social Sciences*, *55*(6), S368–S374.

Baker, D., Gazmararian, J. A., Williams, M. V., Scott, T., Parker, R. M., Green, D., … Peel, J. (2002). Functional health literacy and the risk of hospital admission among Medicare managed care enrollees. *TheAmerican Journal of Public Health*, *92*(8), 1278–1283.

Baker, D., Wolf, M. S., Feinglass, J., Thompson, J. A., Gazmararian, J. A., & Huang, J. (2007). Health literacy and mortality among elderly persons. *Archives of Internal Medicine*, *167*(14), 1503–1509.

Baldi, S. (2009). *Technical report and data file user's manual for the 2003 National Assessment of Adult Literacy* (No. NCES 2009-476). Washington, DC: U.S. Government Printing Office.

Bostock, S., & Steptoe, A. (2012). Association between low functional health literacy and mortality in older adults. *BMJ*, *344*, e1602. doi:10.1136/bmj.e1602

Campbell, R. J., & Nolfi, D. A. (2005). Teaching elderly adults to use the Internet to access health care information: Before–after study. *Journal of Medical Internet Research*, *7*(2), e19. doi:102196/jmir.7.2.e19

Centers for Disease Control and Prevention. (2014). *Health literacy*. Retrieved from http://www.cdc.gov/healthliteracy/

Chen, J. Z., Hsu, H. C., Tung, H. J., & Pan, L. Y. (2013). Effects of health literacy to self-efficacy and preventing

care utilization among older adults. *Geriatrics and Gerontology International*, *13*(1), 70–76. Advance online publication. doi:1111/j.1447-0594.2012.00862.x

Chew, L., Bradley, K., & Boyko, E. J. (2004). Brief questions to identify patients with inadequate health literacy. *Family Medicine*, *36*(8), 588–594.

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155–159.

Cutilli, C. C. (2010). Patient education corner. Seeking health information: What sources do your patients use?*Orthopaedic Nursing*, *29*(3), 214–219.

Feinberg, I., Frijters, J., Johnson-Lawrence, V., Greenberg, D., Nightingale, E., & Moodie, C. (2016). Examining associations between health information seeking behavior and adult education status in the U.S.: An analysis of the 2012 PIAAC data. *PLoS One*. Retrieved September 14, 2106, from http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0148751#authcontrib

Gakumo, C. A., Enah, C. C., Vance, D. E., Sahinoglu, E., & Raper, J. L. (2015). "Keep it simple": Older African Americans' preferences for a health literacy intervention in HIV management. *Patient Preference and Adherence*, *9*, 217–223.

Gazmararian, J., Williams, M., Peel, J., & Baker, D. (2003). Health literacy and knowledge of chronic disease. *Patient Education and Counseling*, *51*, 267–275.

Gollop, C. J. (1997). Health information-seeking behavior and older African American women. *Bulletin of the Medical Library Association*, *85*(2), 141–146.

Greenberg, E., & Jin, Y. (2007). *2003 National Assessment of Adult Literacy: Public-use data file user's guide* (No. NCES 2007-464). Washington, DC: U.S. Government Printing Office.

Hall, A. K., Bernhardt, J. M., & Dodd, V. (2015). Older adults' use of online and offline sources of health information and constructs of reliance and self-efficacy for medical decision making. *Journal of Health Communication*, *20*(7), 751–758.

Healthy People 2020. (n.d.). *Disparities*. Retrieved from https://www.healthypeople.gov/2020/about/foundation-health-measures/Disparities

James, B. D., Boyle, P. A., Yu, L., & Bennett, D. A. (2013). Internet use and decision making in community-based older adults. *Frontiers in Psychology*, *4*, 1–10. doi:10.3389

Kobayashi, L. C., Wardle, J., & von Wagner, C. (2015). Internet use, social engagement and health literacy decline during ageing in a longitudinal cohort of older English adults. *Journal of Epidemiology & Community Health*, *69*(3), 278–283. doi:10.1136/iech-2014-204733

Kobayashi, L. C., Wardle, J., Wolf, M. S., & von Wagner, C. (2015). Cognitive function and health literacy decline in a cohort of aging English adults. *Journal of Internal Medicine*, *30*(7), 958–964. doi:10.1007/s11606-015-3206-9

Kontos, E., Blake, K. D., Chou, W. Y. S., & Prestin, A. (2014). Predictors of eHealth usage: Insights on the digital divide from the Health Information National Trends Survey 2012. *Journal of Medical Internet Research*, *16*(7), e172.

Kutner, M., Greenberg, E., Jin, Y., & Paulsen, C. (2006). *The health literacy of America's Adults: Results from the 2003 National Assessment of Adult Literacy* (No. NCES 2006-483). Washington, DC: U.S. Government Printing Office.

Levy, H., Janke, A. T., & Langa, K. M. (2014). Health literacy and digital divide among older Americans. *Journal of General Internal Medicine*, *30*(3), 284–289. doi:10.1007/s11606-014-3069-5

Mahnoush, R., Javadzade, S. H., Heydarabadi, A. B., Mostafavi, F., Tavassoli, E., & Sharifirad, G. (2015). The relationship between functional health literacy and health promoting behaviors among older adults. *Journal of Education and Health Promotion*, *3*, 119. doi:10.4103/2277-9531.145925

Morey, O. (2007). Health information ties: Preliminary findings on the health information seeking behaviour of an African-American community. *Information Research*, *12*(2), paper 297. Available at http://InformationR.net/ir/12-2/paper297.html.

Mottus, R., Johnson, W., Murray, C., Wolf, M. S., Starr, J. M., & Deary, I. J. (2014). Towards understanding the links between health literacy and physical health. *Health Psychology*, *33*(2), 164-173. doi:10.1037/a0031439

National Center for Education Statistics. (n.d.-a). *National Assessment of Adult Literacy*. Retrieved from http://nces.ed.gov/naal/

National Center for Education Statistics. (n.d.-b). *Data files from the 2003 National Assessment of Adult Literacy*. Retrieved from http://nces.ed.gov/naal/datafiles.asp

Nielsen-Bohlman, L., Panzer, A. M., & Kindig, D. A. (2004). *Health literacy: A prescription to end confusion*. Washington, DC: The National Academies Press.

O'Conor, R., Wolf, M. S., Smith, S. G., Martynenko, M., Vicencio, D. P., Sano, M., … Federman, A. D. (2015). Health literacy, cognitive function, proper use and adherence to inhaled asthma controller medications among older Adults with asthma. *Chest, 147*(5), 1307–1315. doi:10.1378/chest.14-0914

Paasche-Orlow, M. K., & Wolf, M. S. (2007). The causal pathways linking health literacy to health outcomes. *American Journal of Health Behavior*, *31*(Suppl. 1), 819–826.

Pew Research Center. (n.d.). *Older adults and technology use*. Retrieved from http://www.pewinternet.org/2014/04/03/older-adults-and-technology-use/

Pfizer. (2015). *Health literacy*. Retrieved from http://www.pfizer.com/health/literacy

Rubin, D. L., Freimuth, V. S., Johnson, S. D., Kaley, T., & Parmer, J. (2014). Training meals on wheels volunteers as health literacy coaches for older adults. *Health Promotion Practice*, *15*(3), 448–454. doi:10.1177/1524839913494786

Sequeira, S. S., Eggermont, L. H., Silliman, R. A., Bickmore, T. W., Henault, L. E., Winter, M. R., … Orlow, M. K. (2013). Limited health literacy and decline in executive functioning in older adults. *Journal of Health Communication*, *18*(Suppl. 1), 143–157. doi:10.1080/10810730.2013.825673

Smith, S. G., O'Conor, R., Curtis, L. M., Waite, K., Deary, I. J., Paasche-Orlow, M., & Wolf, M. S. (2015). Low health literacy predicts decline in physical function among older adults: Findings from the LitCog cohort study. *Journal of Epidemiology & Community Health*, *69*(5):474–480. doi:10.1136/jech-2014-204915

Sudore, R., Mehta, K. M., Simonsick, E. M., Harris, T. B., Newman, A. B., Satterfield, S., … Yaffe, K. (2006). Limited literacy in older people and disparities in health and healthcare access. *Journal of the American Geriatrics Society*, *54*(5), 770–776.

Tennant, B., Stellefson, M., Dodd, V., Chaney, D., Paige, S., & Alber, J. (2015). eHealth literacy and web 2.0 health information seeking behaviors among baby boomers and older adults. *Journal of Medical Internet Research*, *17*(3), e70. doi:10.2196/jmir.3992

The Joint Commission. (n.d.). *"What did the doctor say?" Improving health literacy to protect patient safety*. Retrieved from http://www.jointcommission.org/What_Did_the_Doctor_Say/

Tian, Y., & Robinson, J. D. (2008). Media use and health information seeking: An empirical test of complementarity theory. *Health Communication*, *23*(2), 184–190.

Wallston, K. A., Cawthorn, C., McNaughton, C. D., Rothman, R. L., Osborn, C. Y., & Kripalani, S. (2014). Psychometric properties of the brief health literacy screen in clinical practice. *Journal of General Internal Medicine*, *29*(1), 119–126. doi:10.1007/s11606-013-2568-0

White, S. (2008). *Assessing the nation's health literacy: Key concepts and findings of the National Assessment of Adult Literacy (NAAL)* (No. OP423908). Chicago, IL: American Medical Association Foundation.

White, S., & Dillow, S. (2005). *Key concepts and features of the 2003 National Assessment of Adult Literacy* (No. NCES 2006-471). Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Wolf, M. S., Gazmararian, J. A., & Baker, D. (2005). Health literacy and functional health status among older adults. *Archives of Internal Medicine*, *165*(17), 1946–1952. doi:10.1001/archinte.165.17.1946

Wu, J. R., Moser, D. K., DeWalt, D. A., Rayens, M. K., & Dracup, K. (2016). Health literacy mediates the relationship between age and health outcomes in patients with heart failure. *Circulation: Heart Failure*, *9*(1), e002250. doi:10.1161/CIRCHEARTFAILURE.115.002250