

Self-reported Health Literacy Among North Carolina Adults and Associations with Health Status and Chronic Health Conditions

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BACKGROUND Low health literacy is a recognized contributor to health disparities. Significant proportions of the adult population, especially the underserved, have low health literacy. The purpose of this study was to examine health literacy and its associations with health status and chronic health conditions among North Carolina adults.

METHODS The 2016 North Carolina Behavioral Risk Factor Surveillance System included health literacy questions that focused on accessing and understanding health information. Using these self-reported data, we estimated the prevalence of low health literacy and assessed its associations with general health status and chronic health conditions after adjusting for sociodemographic characteristics and health care access.

RESULTS Overall, 4.8% of adults reported having difficulty getting health information or advice, 7.5% understanding oral information from health professionals, and 8.3% understanding written health information; 14.8% reported having difficulty with at least one of these tasks. The adjusted odds of low health literacy were moderately higher for those who had been diagnosed with the following conditions compared to those not diagnosed: heart attack, coronary heart disease, or stroke (AOR = 1.81, 95% CI=1.33, 2.47); COPD (AOR = 1.67, 95% CI = 1.19, 2.34); arthritis (AOR = 1.68, 95% CI = 1.32, 2.15); depression (AOR = 1.95, 95% CI=1.52, 2.50); and kidney disease (AOR = 1.62, 95% CI = 1.02, 2.60).

LIMITATIONS All data were self-reported.

CONCLUSIONS A notable segment of the North Carolina adult population has low health literacy, and those who do are particularly vulnerable to adverse health status. Targeted efforts are needed to identify strategies to improve health literacy and decrease health disparities.

Health literacy was initially conceptualized in the 1970s based on reading and numerical skills, but over time has become increasingly multidimensional [1]. Sorensen and colleagues defined the dimensions of health literacy as the ability to access or obtain health information, to understand health information, to process or appraise health information, and to apply or use this information [2]. Although consensus has not been reached on its definition, one common definition of 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” [3]. Health literacy includes components of literacy more generally, such as oral literacy (listening and speaking), print literacy (reading and writing), and numeracy, but is distinct as it also includes the ability to obtain information and to use this information to make health-related decisions. Health literacy is not only based on the skills of individuals but also on the communication skills of those with whom they interact, especially health care workers, and on the values of health care systems and how they intervene [4].

On reviewing the literature, Berkman and colleagues found that low health literacy was associated with higher emergency care use and increased hospitalization, worse self-management of chronic diseases, and higher rates of mortality among the elderly [5]. Low health literacy has

also been associated with lower self-rated health status [6], lower medication adherence [7, 8], and lower levels of diabetes-related knowledge and some diabetes outcomes [9]. In a large cohort study of Medicare patients, those with inadequate health literacy had significantly higher rates of cardiovascular death [10]. In consideration of this growing body of research, Healthy People 2020, a 10-year agenda for improving the health of all Americans, included three objectives aimed to “improve the health literacy of the population” [11].

There is limited population-based data on the prevalence of health literacy and its relationship to health status and chronic conditions. The North Carolina Behavioral Risk Factor Surveillance System (BRFSS) included questions about health literacy for the first time in 2016. The purpose of this study was to examine the prevalence of difficulty with three health literacy tasks among North Carolina adults and associations of low health literacy with health status and chronic health conditions. We hypothesized that health

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literacy problems would be more common among racial/ethnic minorities and those with low levels of formal education and household income, and that low health literacy would be associated with poorer health status and chronic conditions.

Methods

The BRFSS is a random telephone survey of adults aged 18 years or older conducted annually by all 50 states, the District of Columbia, and several US territories and coordinated by the Centers for Disease Control and Prevention (CDC). The BRFSS collects self-reported information on health behaviors, preventive health practices, and chronic health conditions related to the leading causes of death and disability. State-level questionnaires include the required core questions from the CDC, selected CDC-supported optional modules, and state-added questions [12]. The CDC developed a three-question BRFSS Health Literacy optional module focused on health information and advice-seeking skills, oral literacy, and print literacy. This optional module was first offered in 2016 and fielded by the District of Columbia and 16 states, including North Carolina. The 2016 North Carolina BRFSS data were downloaded from the CDC BRFSS website (www.cdc.gov/brfss) and analyzed for this analysis (N = 5,569).

Measurements

Health literacy. The three health literacy questions were: 1) "How difficult is it for you to get advice or information about health or medical topics if you need it?" (get health advice or information); 2) "How difficult is it for you to understand information that doctors, nurses and other health professionals tell you?" (understand oral health information); and 3) "In general, how difficult is it for you to understand written health information?" (understand written health information). Pre-coded responses were: "Very easy"; "Somewhat easy"; "Somewhat difficult"; and "Very difficult." Not-applicable response categories were available for the first question ("I don't look for health information") and the third question ("I don't pay attention to written health information.") and were considered missing in the analysis. "Somewhat difficult" and "Very difficult" responses were combined into one category ("difficult"). Low health literacy was defined as having difficulty with one or more of the three health literacy tasks.

Sociodemographic characteristics and health care access. We included the following sociodemographic variables in the analysis: age (young adults aged 18-34 years, middle-aged adults aged 35-64 years, older adults aged \geq 65 years), gender (male, female), education (< high school, high school graduate, some college, \geq college graduate), and annual household income (< \$25,000, \$25,000-\$49,999, \geq \$50,000, missing). Information on race, Hispanic ethnicity, and interview language (English, Spanish) was combined into a race/

ethnicity variable (non-Hispanic White, non-Hispanic Black, English-speaking Hispanic, Spanish-speaking Hispanic, other). The following health care access variables were examined: health insurance (yes, no), and personal doctor (yes, no).

Health status and chronic conditions. The health status and chronic conditions variables included: self-rated general health (excellent/very good/good versus fair/poor) and diagnosis of chronic health conditions (asthma, skin cancer, non-skin cancers, chronic obstructive pulmonary disease [COPD], arthritis, depression, kidney disease, and diabetes). We created a categorical variable for number of chronic health conditions (0, 1, \geq 2) following the algorithm of Ward and Black [13].

Statistical Analysis

Prevalence of each level of difficulty (very easy, somewhat easy, difficult) was calculated for each of the three health literacy measures (getting health advice or information, understanding oral health information, and understanding written health information). These prevalence estimates were also calculated by sociodemographic characteristics and indicators of health care access because of their underlying importance to describing health. The prevalence of low health literacy (having difficulty with one or more health literacy tasks) was examined by health status and chronic health conditions. Rao-Scott chi-square tests were used to assess bivariate relationships; statistical significance for the chi-square tests was set at $P < .001$ because of the number of statistical tests conducted. Logistic regression models were used to assess the bivariate relationships between low health literacy and health status and chronic health conditions after adjusting for sociodemographic and health care access variables. Analysis weights calculated by the CDC were used; these weights incorporate the sampling design and adjust to demographic characteristics of the population, making the resulting estimates more representative of the North Carolina adult population. Data were analyzed using SAS Version 9.4 (Cary, NC); we used SAS survey procedures to account for the complex survey design and analysis weights, and all results were weighted (except for sample sizes).

Results

Health Literacy by Sociodemographic and Health Care Access Characteristics

Tables 1a-1c present results from each of the three health literacy questions by categories of the sociodemographic characteristics, health insurance, and whether the respondent had a personal doctor. Over three-quarters (76.8%) reported that it was very easy to get health advice or information, 18.4% found it somewhat easy, and 4.8% found it difficult; 63.7% found understanding oral health information very easy, 32.0% somewhat easy, and 7.5%

TABLE 1A.
Level of Difficulty For North Carolina Adults to Get Advice or Information About Health Care or Medical Topics* By Sociodemographic Characteristics and Health Access, 2016 North Carolina BRFSS

	Unweighted sample size	Very easy %	Somewhat easy %	Difficult %	P-value**
Total	5234	76.8	18.4	4.8	
Age in years					
18-34	890	75.5	20.2	4.4	0.346
35-64	2645	77.1	17.6	5.3	
65+	1640	78.1	17.9	4.0	
Gender					
Male	2280	75.5	20.0	4.6	0.101
Female	2951	77.9	17.0	5.1	
Race/ethnicity					
White, non-Hispanic	3561	78.7	17.4	3.9	<0.001
Black, non-Hispanic	1043	79.5	16.1	4.4	
Hispanic, English speaking	111	73.5	20.8	5.8	
Hispanic, Spanish speaking	218	44.3	38.7	17.0	
Other	247	70.6	21.6	7.8	
Education					
Less than high school graduate	536	56.7	29.8	13.5	<0.001
High school graduate	1429	72.5	22.2	5.3	
Some college	1576	80.7	16.0	3.2	
College graduate	1680	87.5	10.9	1.5	
Household income					
Less than \$25,000	1332	64.2	25.5	10.2	<0.001
\$25,000-49,999	1144	73.8	22.8	3.3	
\$50,000 or greater	1849	86.9	11.9	1.2	
Missing	909	76.5	16.7	6.7	
Health care access					
Health insurance					
No	560	55.2	27.6	17.2	<0.001
Yes	4656	80.0	17.0	3.0	
Personal doctor					
None	819	66.3	23.4	10.4	<0.001
At least one	4404	79.2	17.1	3.6	

*Response to the question, "How difficult is it for you to get advice or information about health or medical topics if you need it?"

**Rao-Scott chi-square P-value

found it difficult (Table 1b); and 64.2% found understanding written information very easy, 27.5% somewhat easy, and 8.3% found this task difficult (Table 1c). Statistically significant associations ($P < .001$) were found between each health literacy task and race/ethnicity, education, household income, and health insurance. Age was significantly associated with only difficulty understanding written health information, which ranged from 6.7% of those aged 18-64 years to 9.8% of those aged 65 years or older ($P < .001$). Having a personal doctor was significantly associated with getting health information or advice and with understanding what doctors and other health professionals said orally.

Low Health Literacy by Health Status and Chronic Conditions

We estimated that 14.8% of North Carolina adults had low health literacy, based on self-reported difficulty with one or more health literacy tasks. Table 2 presents the prevalence of low health literacy and adjusted odds ratios by general health status and chronic conditions. The adjusted odds of low health literacy among those in fair or poor health were over twice the odds for those in excellent to good health (AOR = 2.14, 95% confidence interval [CI] = 1.65, 2.77). Those who had ever been diagnosed with a heart attack, coronary heart disease, or stroke; chronic obstructive pulmonary disease (COPD); arthritis; depression;

TABLE 1B.
Level of Difficulty For North Carolina Adults to Understand Oral Information from Health Professionals* by Sociodemographic Characteristics and Health Care Access, 2016 North Carolina BRFSS

	Unweighted sample size	Very easy %	Somewhat easy %	Difficult %	P-value**
Total	5516	63.7	28.8	7.5	
Age in years					
18-34	953	62.1	32.0	5.8	0.155
35-64	2762	64.5	27.0	8.5	
65+	1738	63.3	29.4	7.3	
Gender					
Male	2437	61.4	30.9	7.7	0.029
Female	3076	65.7	27.0	7.3	
Race/ethnicity					
White, non-Hispanic	3719	65.2	28.3	6.6	<0.001
Black, non-Hispanic	1114	65.8	26.7	7.6	
Hispanic, English speaking	115	62.4	32.2	5.4	
Hispanic, Spanish speaking	244	36.1	44.9	19.0	
Other	269	61.1	28.7	10.1	
Education					
Less than high school graduate	629	41.8	39.0	19.1	<0.001
High school graduate	1521	59.5	31.7	8.7	
Some college	1639	67.9	27.1	5.0	
College graduate	1712	76.6	21.4	2.0	
Household income					
Less than \$25,000	1441	52.1	34.8	13.1	<0.001
\$25,000-49,999	1204	61.3	32.1	6.7	
\$50,000 or greater	1894	74.2	23.2	2.6	
Missing	977	61.5	28.1	10.4	
Health care access					
Health insurance					
No	614	49.4	36.7	13.9	<0.001
Yes	4884	66.0	27.5	6.5	
Personal doctor					
None	904	56.2	33.3	10.5	<0.001
At least one	4600	56.6	27.7	6.8	

*Response to the question, "How difficult is it for you to understand information that doctors, nurses and other health professionals tell you?"

**Rao-Scott chi-square P-value

or kidney disease had 62%-95% higher odds of low health literacy compared with those who did not have that diagnosis. In addition, those who had been diagnosed with two or more of these chronic health conditions had over twice the odds of having low health literacy compared with those who had not been diagnosed with any of them (AOR = 2.22, 95% CI = 1.64, 2.99).

Discussion

The 2016 BRFSS results showed that 5%-8% of North Carolina adults had difficulty getting health advice or information, understanding oral health information, and understanding written health information. We estimated that 14.8%, or nearly 1.2 million North Carolina adults, had dif-

ficulty with at least one of these tasks, thus limiting their ability to access health care and make informed, appropriate health care decisions. Difficulty with each of the examined health literacy tasks was strongly associated with lower socioeconomic status and race/ethnicity. The 2003 National Assessment of Adult Literacy (NAAL), a national population-based survey that assessed English literacy using objective measures and included 28 health-related questions, estimated that only 12% of US adults had proficient health literacy, 53% intermediate health literacy, 22% basic, and 14% below basic health literacy [14]. Despite the differences in scope (28 questions versus three questions) and measurement (objective measurement of text comprehension versus subjective self-report of one's own ability) between the

TABLE 1C.
Level of Difficulty for North Carolina Adults to Understand Written Health Information* by Sociodemographic Characteristics and Health Care Access, 2016 North Carolina BRFSS

	Unweighted sample size	Very easy %	Somewhat easy %	Difficult %	P-value**
Total	5265	64.2	27.5	8.3	
Age in years					
18-34	902	67.4	25.9	6.7	<0.001
35-64	2662	66.0	25.4	8.6	
65+	1642	56.5	33.8	9.8	
Gender					
Male	2297	61.7	29.1	9.1	0.024
Female	2966	66.3	26.0	7.7	
Race-ethnicity					
White, non-Hispanic	3558	66.0	26.6	7.4	<0.001
Black, non-Hispanic	1059	63.0	28.7	8.3	
Hispanic, English speaking	109	72.5	17.9	9.6	
Hispanic, Spanish speaking	229	38.5	42.0	19.5	
Other	260	62.6	26.2	11.3	
Education					
Less than high school graduate	546	38.0	37.5	24.5	<0.001
High school graduate	1427	56.4	33.8	9.8	
Some college	1600	70.1	24.9	4.9	
College graduate	1679	79.4	18.6	2.0	
Household income					
Less than \$25,000	1331	50.9	33.1	16.1	<0.001
\$25,000-49,999	1164	61.0	32.6	6.4	
\$50,000 or greater	1853	75.0	22.0	3.0	
Missing	917	64.0	25.1	10.9	
Health care access					
Health insurance					
No	577	52.6	31.8	15.6	<0.001
Yes	4672	65.9	26.9	7.2	
Personal doctor					
None	844	59.4	30.3	10.3	0.024
At least one	4412	65.3	26.8	7.9	

*Response to the question, "In general, how difficult is it for you to understand written health information?"

**Rao-Scott chi-square P-value

NAAL and the BRFSS measurements, the NAAL 14% estimate of those with below basic health literacy was similar in magnitude to the estimate of North Carolina adults who had difficulty with at least one of the three health literacy tasks (14.8%). We also found relationships similar to those reported by NAAL between low health literacy and low education, low income, and Hispanic ethnicity. Another example of population-based measurement of health literacy comes from the 2012 Kansas BRFSS, which included a module of three self-report health literacy questions developed by Chew and colleagues [15]; these survey results indicated that 8.6% of adults in Kansas had low health literacy [16].

The 2016 North Carolina BRFSS showed that, even after adjusting for sociodemographic characteristics and health

care access, fair-to-poor general health status was associated with low health literacy, as were heart disease/stroke, COPD, arthritis, depression, and kidney disease. Our results indicated that the adjusted odds of low health literacy increased consistently with the number of chronic health conditions, and that those with two or more conditions had over twice the odds of low health literacy compared with those who had not been diagnosed with any of these conditions. We estimated that in 2016 approximately 325,000 North Carolina adults had difficulty with health literacy tasks and also had two or more chronic health conditions (data not shown).

National attention has been focused on health literacy; national organizations have convened experts and issued

TABLE 2.
Prevalence of Low Health Literacy (Difficulty with One or More Health Literacy Tasks) and Adjusted Odds Ratios by General Health Status and Chronic Health Conditions, North Carolina BRFSS 2016

	Unweighted sample size	Having difficulty with ≥ 1 health literacy tasks		Adjusted odds ratio (AOR)**	
		%	P-value*	AOR	95% confidence interval
Total	5311	14.8			
Health status					
General health					
Fair - poor	1122	31.0	<0.001	2.14	1.65, 2.77
Excellent - good	4175	10.9		1.00	
Chronic health conditions					
Had heart attack, coronary heart disease, or stroke					
Yes	674	26.4	<0.001	1.81	1.33, 2.47
No	4585	13.3		1.00	
Current asthma					
Yes	436	22.6	<0.001	1.34	0.94, 1.92
No	4848	14.1		1.00	
Skin cancer					
Yes	552	16.2	0.474	1.19	0.83, 1.70
No	4749	14.7		1.00	
Other cancer					
Yes	465	19.3	0.033	1.41	0.97, 2.04
No	4837	14.5		1.00	
COPD					
Yes	455	28.6	<0.001	1.67	1.19, 2.34
No	4839	13.6		1.00	
Arthritis					
Yes	1770	21.0	<0.001	1.68	1.32, 2.15
No	3518	12.3		1.00	
Depression					
Yes	1070	23.9	<0.001	1.95	1.52, 2.50
No	4219	12.6		1.00	
Kidney Disease					
Yes	212	25.4	<0.001	1.62	1.02, 2.60
No	5083	14.4		1.00	
Diabetes					
Yes	782	20.3	<0.001	1.44	0.85, 1.53
No	4523	14.0		1.00	
Multiple chronic conditions					
≥ 2 conditions	1378	23.9	<0.001	2.22	1.64, 2.99
1 condition	1503	13.7		1.31	0.97, 1.75
No chronic conditions	2429	11.6		1.00	

*Rao-Scott chi-square P-value

**Adjusted for age, gender, race-ethnicity, education, household income, health insurance, and personal doctor

policy papers. The Institute of Medicine of the National Academies (now the National Academy of Medicine) convened the Committee on Health Literacy and published *Health Literacy: A Prescription to End Confusion* in 2004 which included many policy recommendations [3]. The US Department of Health and Human Services convened a

Health Literacy Workgroup, which resulted in the release of a National Action Plan to Improve Health Literacy in May 2010 that outlined a vision of a society that “provides everyone with access to accurate and actionable health information, delivers person-centered health information and services, and supports lifelong learning and skills to promote good

health" [17]. This national action plan also included seven interdisciplinary goals for achieving this vision, emphasizing that health literacy has interpersonal and system-level components as well as individual-level ones. Three of the goals from this action plan relate directly to health care: 1) "Develop and disseminate health and safety information that is accurate, accessible, and actionable;" 2) "Promote changes in the health care system that improve health information, communication, informed decision-making, and access to health services;" and 3) "Increase the dissemination and use of evidence-based health literacy practices and interventions" [17]. The North Carolina Institute of Medicine also convened a task force to study health literacy in North Carolina that produced a 2007 report with 14 state-specific recommendations [18]. These state-specific recommendations ranged from incorporating health literacy curricula into the training of new health professionals and continuing education for practitioners, to developing requirements for oral and written consumer medication information and prescription labeling, to testing new models of care that would improve health literacy in North Carolina [18]. A 2010 update reported that 11 of the 14 recommendations had been partially implemented [19].

Low health literacy may have important consequences for North Carolina, which has a population over 10 million and was ranked the ninth largest state in the United States in 2017 [20]. North Carolina has a less educated population than the United States as a whole, which would tend to increase problems with health literacy. Approximately 14% of North Carolinians aged 25 or older have less than a high school education compared with approximately 10% of this age group in the wider United States [21]; the North Carolina high school graduation rate is also lower than that of the United States as a whole (83% versus 86%) [22]. The most current North Carolina BRFSS results indicate that over half of North Carolina adults have at least one chronic disease, 26% have one chronic disease, and an additional 27% have two or more [23]. As people live longer, and live longer with chronic conditions, it will be a continuing challenge for the medical community to ensure that adults in North Carolina have adequate, understandable medical information available to them in order that they can optimally manage their conditions.

Limitations

The data from the North Carolina BRFSS are self-reported, and these estimates are likely to underestimate the true prevalence of low health literacy due to social desirability bias and nonresponse from some of those who are the least health literate. Another limitation is that exposure to and need for health care and information about health would affect these self-report measures of health literacy. For example, an adult who is in good health and has little need for health care beyond an annual checkup may think that they easily understand oral and written health informa-

tion, however, they may be unaware that they would have difficulty if they were in a position to need such information. The data used in this analysis are cross-sectional, so cause and effect cannot be examined. There is still no consensus on the definition of or conceptual framework for health literacy [24, 25], which limits our ability to compare our results with those from other sources. To our knowledge, there has been no validation work done specifically on the three subjective BRFSS health literacy questions, although there has been some validation work on other subjective measures of health literacy by comparing results of new tools with those from an older objectively measured tool, for example, the work of Chew and colleagues [15].

Our study showed that a notable level of low health literacy exists among North Carolina adults, especially among those with lower socioeconomic status and those with multiple chronic health conditions. Reducing the barriers to accessing and understanding health information for all people in North Carolina has become a priority. A two-pronged approach is needed: now and in the foreseeable future there is a need to make health information available and understandable to all, and health literacy needs to be a focus in our education system—both the K-12 system as well as adult education—to develop a more health-literate and healthy society. **NCMJ**

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