Health Literacy and Cardiovascular Disease Risk Factors Among the Elderly: A Study From a Patient-Centered Medical Home

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America is graying at a rapid rate, and almost half of the elderly have a functional literacy deficiency.[1] Literacy is important in every walk of life, and even more so in health-related matters. Health literacy (HL)—the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions—influences the use of healthcare, facilitates comprehending the vulnerability caused by health risk behaviors, and provides an impetus to seek improved health outcomes with a lower cost of care.[2] As a result, over the last 2 decades, a significant interest has been generated in assessing the impact of HL on health status, morbidity, mortality, and healthcare cost, among different segments of the population.[3-6]

A leading cause of mortality among the elderly is cardiovascular disease (CVD). The CVD risk factors (CVDRFs) can be classified on the basis of type of risk into 2 categories: modifiable (eg, elevated blood pressure [BP], blood glucose and total cholesterol [TC], overweight, and tobacco use) and nonmodifiable (eg, age, gender, and family history). Most of the modifiable risk factors are within the control of an individual and can be contained or treated. Adequate HL is essential in disease management, particularly for patient self care and adherence to treatment regimens.[7] Although there have been many reports recently on the effects of HL on CVD, most have focused on heart failure, a complex chronic condition with high mortality rates.[8-10] Consequently, evaluation of the relationship of HL and CVD risk merits consideration.

The purpose of this study was to determine the HL level of elderly patients and to establish whether an association exists between HL and the control of CVDRFs. The study was designed to provide information to clinicians to help facilitate better management of patients with CVDRFs.

ABSTRACT

Background

Health literacy (HL) influences the use of healthcare, facilitates comprehension of health risk behaviors and subsequent vulnerabilities, and provides an impetus to seek improved health outcomes with lower cost of care.

Objectives

To determine the HL level of elderly patients and establish whether an association exists between HL and cardiovascular disease risk factors (CVDRFs).

Methods

A total of 150 elderly patients seeking care at a patient-centered medical home (PCMH) were administered the Nutritional Literacy Scale (NLS) and Short Test of Functional Health Literacy in Adults (STOFHLA). Sociodemographic, physiological, biochemical, and disease profile data were obtained.

Results

The patients were 68.7% female, 67.3% African American, 4.7% smokers, and 72.5% overweight. They had a mean age of 74.6 years, 13.2 years education, body mass index of 28.9 kg/m^2, systolic blood pressure of 138.5 mm Hg, diastolic blood pressure of 70.7 mm Hg, fasting blood glucose of 100.6 mg/dL, and glycated hemoglobin of 6.6%. Their mean lipid values were: total cholesterol (TC), 188.0 mg/dL; high-density lipoprotein cholesterol, 54.3 mg/dL; low-density lipoprotein (LDL) cholesterol, 111.8 mg/dL; and triglycerides, 115.8 mg/dL. The cohort had 88% hypertensives and 32% diabetics. They scored a mean of 20.9 on the NLS and 29.6 on STOFHLA, with 16% lacking adequate scores on both scales. Lower education attainment was linked to higher TC ($P = .027$) and LDL cholesterol ($P = .023$), but no association was observed between HL and all the independent CVDRFs evaluated.

Conclusions

The study shows that a majority of the participating elderly PCMH patients had a higher level of education (≥12 years) and an adequate level of HL. A higher level of education, but not HL, appears to be predictive of a better control of CVDRFs.

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METHODS

Study Design and Population

This prospective study was designed as a clustered sampling of older patients seeking care at Rosa Parks Wellness Institute for Senior Health (RP-WISH), a patient-centered medical home affiliated with Wayne State University (WSU) and Detroit Medical Center that provides healthcare to 3000 patients. The study was approved by the WSU Institutional Review Board and performed according to approved ethical guidelines of human participant research.

Patients had to undergo a clinical examination to participate in the study and: 1) be aged ≥60 years, free from terminal illness and visual impairment, and able to communicate in English and follow directions; 2) not be cognitively impaired, scheduled for surgery, or on dialysis, chemotherapy, or radiation therapy; 3) not be a nursing home resident; and 4) agree to participate and provide written informed consent.

Take-Away Points

The study was conducted to determine the health literacy (HL) of elderly patients seeking care at a patient-centered medical home and establish whether an association exists between HL and cardiovascular disease risk factors (CVDRFs). Although the level of education of the patient strongly correlated with HL and was also associated with some CVDRFs, no such association with CVDRFs was observed with HL. Consequently, HL may not be an appropriate tool in assessment of CVDRFs among the elderly.

The findings of this study would impact elderly patients in:

- Care and disease management.
- Clinical time management.
- Cost of clinical care.

Measures

Patients who met the inclusion criteria and voluntarily consented to participate were included in the study. A research coordinator recorded the following data and administered assessment scales using a face-to-face interview technique during the participant's initial visit (the exception was BP, recorded as mean of the measurements on 3 successive visits): 1) sociodemographic: age, gender, ethnicity, education, weight, height, body mass index (BMI), health insurance, and tobacco use (smoker/nonsmoker); 2) physiological: BP (systolic [SBP] and diastolic [DBP]); 3) biochemical: fasting blood glucose, glycated hemoglobin [A1C], and lipid profile (TC, high-density lipoprotein [HDL] cholesterol, low-density lipoprotein [LDL] cholesterol, and triglycerides); 4) disease profile: hypertension and diabetes; and 5) HL scales: Nutritional Literacy Scale (NLS)[11] and Short Test of Functional Health Literacy in Adults (STOFHLA).[12]

Our patients were permitted sufficient time to complete the HL scales, NLS and STOFHLA, which can take longer to administer to the elderly.[13] The NLS measures HL with 24 questions designed to evaluate the patient's understanding of current nutrition labels, and includes an actual nutritional label that the patient observes. Half of the questions are open-ended. For the other half, the patient must choose between 2 responses. NLS scores are classified as inadequate (0-7), marginal (8-14), and adequate (15-28).[11] The STOFHLA is a measure of the ability to read and understand prose passages (prose literacy), appointment slips (document literacy), and prescription bottles containing numerical information (quantitative literacy). STOFHLA scores are classified as inadequate (0-16), marginal (17-22), and adequate (23-36).[12] The patients were characterized as low risk or high risk for each CVDRF on the basis of American College of Cardiology Practice Guidelines (Table 1).[14,15]

Statistical Analysis

The data were analyzed using SPSS for Windows version 20.0 (IBM SPSS Inc, Chicago, Illinois). For analysis purposes, patients were grouped by age (<75 and ≥75 years), education (≤high school and ≥college) and CVDRFs (low risk and high risk). Continuous data (eg, age) of the 2 groups were analyzed using *t* test, and categorical data (eg, gender) associations were evaluated using χ^2 test.

Table 1. Definitions of Low-Risk and High-Risk Categories for Each Cardiovascular Disease Risk Factor

Cardiovascular Disease Risk Factor	Low Risk	High Risk
Body mass index (kg/m^2)	<25	≥25
Systolic blood pressure (mm Hg)	<140	≥140
Diastolic blood pressure (mm Hg)	<90	≥90
Fasting blood glucose (mg/dL)	<126	≥126
Glycated hemoglobin (%)	≤6.49	≥6.50
Total cholesterol (mg/dL)	<200	≥200
High-density lipoprotein cholesterol (mg/dL)	≥40	<40
Low-density lipoprotein cholesterol (mg/dL)	<130	≥130
Triglycerides (mg/dL)	<200	≥200
Tobacco use	Nonsmoker	Smoker

Table 2. Patient Characteristics by Age and Education

Variable	Entire Sample M ± SD/n (%)	Aged <75 years M ± SD/n (%)	Aged ≥75 years M ± SD/n (%)	*P*	≤High School M ± SD/n (%)	≥College M ± SD/n (%)	*P*
Number of patients (N)	150 (100.0)	68 (45.3)	82 (54.7)		77 (51.3)	73 (48.7)	
Age (years)	74.6 ± 9.0	66.9 ± 6.6	81.1 ± 4.5	—	75.5 ± 9.6	73.7 ± 8.3	.212
Gender				.029			.048
Female	103 (68.7)	40 (58.8)	63 (76.8)		59 (76.6)	44 (60.3)	
Male	47 (31.3)	28 (41.2)	19 (23.2)		18 (23.4)	29 (39.7)	
Ethnicity				.201			.198
African American	101 (67.3)	49 (72.1)	52 (63.4)		57 (74.0)	44 (60.3)	
Caucasian	19 (12.7)	5 (7.4)	14 (17.1)		8 (10.4)	11 (15.1)	
Other	30 (20.0)	14 (20.6)	16 (19.5)		12 (15.6)	18 (24.7)	
Education (years)	13.2 ± 2.8	13.6 ± 2.4	12.8 ± 3.0	.074	11.0 ± 1.5	15.5 ± 1.7	—
BMI (kg/m^2)	28.9 ± 5.9	31.2 ± 5.9	27.2 ± 5.4	.001	29.2 ± 6.2	28.6 ± 5.7	.635
Blood pressure (mm Hg)							
Systolic	138.5 ± 16.7	136.8 ± 16.8	139.7 ± 16.6	.326	138.3 ± 15.7	138.6 ± 17.9	.925
Diastolic	70.7 ± 9.1	73.0 ± 8.9	68.9 ± 9.0	.009	70.0 ± 8.9	71.4 ± 9.4	.366
Tobacco use	7 (4.7)	4 (5.9)	3 (3.7)	.799	4 (5.2)	3 (4.1)	.998
Blood glucose (mg/dL)	100.6 ± 37.7	107.3 ± 46.9	95.8 ± 28.7	.104	101.8 ± 45.0	99.4 ± 28.0	.736
Glycated hemoglobin (%)	6.6 ± 1.7	6.7 ± 1.9	6.5 ± 1.2	.574	6.8 ± 2.0	6.4 ± 1.1	.371
Lipid profile (mg/dL)							
Total cholesterol	188.0 ± 45.4	187.8 ± 41.3	188.3 ± 49.2	.962	196.8 ± 50.4	176.6 ± 35.4	.027
HDL cholesterol	54.3 ± 15.1	52.6 ± 14.5	55.9 ± 15.5	.280	54.4 ± 15.9	54.2 ± 14.2	.937
LDL cholesterol	111.8 ± 45.6	113.5 ± 50.7	110.2 ± 41.0	.723	120.8 ± 52.1	100.0 ± 32.4	.023
Triglycerides	115.8 ± 58.1	125.7 ± 72.8	107.0 ± 39.7	.110	120.7 ± 65.3	109.3 ± 47.0	.331
Concomitant diseases							
Diabetes	48 (32.0)	28 (41.2)	20 (24.4)	.044	24 (31.2)	24 (32.9)	.961
Hypertension	132 (88.0)	58 (85.3)	74 (90.2)	.499	69 (89.6)	63 (86.3)	.710
NLS	20.9 ± 6.2	22.4 ± 5.0	19.7 ± 6.8	.008	18.4 ± 6.5	23.6 ± 4.6	.001
STOFHLA	29.6 ± 7.1	31.5 ± 5.1	28.0 ± 8.1	.002	27.5 ± 8.4	31.8 ± 4.5	.001

BMI indicates body mass index; HDL, high-density lipoprotein cholesterol; LDL, low-density lipoprotein cholesterol; M, mean; NLS, Nutritional Literacy Scale; STOFHLA, Short Test of Functional Health Literacy in Adults.

Pearson correlation coefficients were used for analysis of associations between HL and continuous data. Results are presented as mean ± standard deviation or as number and percentage. Statistical significance was established at *P* <.05.

RESULTS

Sample characteristics of 150 elderly patients, partitioned by age and education, are presented in Table 2. The group had a mean age of 74.6 years and a mean total of 13.2 years of education. They were 68.7% female, 67.3% African American, and 4.7% smokers, and all possessed public or private health insurance. A majority (72.5%) were overweight; mean measurements included BMI 28.9 kg/m^2, SBP 138.5 mm Hg, DBP 70.7 mm Hg, fasting blood glucose 100.6 mg/dL, and A1C 6.6%. Their mean lipid values (mg/dL) were TC, 188.0; HDL cholesterol, 54.3; LDL cholesterol, 111.8; and triglycerides, 115.8. As for concomitant diseases, hypertension was observed in 88%, whereas 32% had diabetes. Overall, the cohort scored 20.9 on NLS; the scores put 3.3% classified as inadequate, 12.7% as marginal, and 84% as adequate. The mean score was 29.6 on STOFHLA; those scores served to classify 7.3% as inadequate, 8.7% as marginal, and 84% as adequate.

The study results partitioned by age and education show a higher percentage of females who were older (*P* = .029) and lesser educated (*P* = .048). A lower DBP (*P* = .009)

Table 3. Health Literacy Scores of Patients in Low-Risk and High-Risk CVD Categories (N = 150)

Cardiovascular Disease Risk Factor	Low-Risk NLS M ± SD	High-Risk NLS M ± SD	*P*	Low-Risk STOFHLA M ± SD	High-Risk STOFHLA M ± SD	*P*
Body mass index	20.3 ± 6.5	20.8 ± 6.1	.734	29.6 ± 7.8	29.7 ± 6.6	.969
Systolic blood pressure	21.7 ± 5.8	19.8 ± 6.8	.085	30.2 ± 6.5	28.2 ± 7.9	.104
Diastolic blood pressure	20.8 ± 6.4	20.5 ± 3.4	.916	29.2 ± 7.3	32.8 ± 3.3	.331
Blood glucose	20.7 ± 6.2	20.7 ± 3.8	.966	29.7 ± 7.0	29.7 ± 6.0	.975
Glycated hemoglobin	20.1 ± 5.9	20.5 ± 4.9	.806	28.5 ± 7.1	29.9 ± 6.5	.478
Total cholesterol	20.8 ± 5.9	21.0 ± 6.5	. 846	28.8 ± 6.4	30.1 ± 7.5	.400
HDL cholesterol	21.2 ± 6.1	19.0 ± 5.6	. 170	29.6 ± 6.6	28.2 ± 7.7	.468
LDL cholesterol	20.8 ± 6.2	20.9 ± 5.7	.969	28.8 ± 6.9	31.0 ± 6.0	.152
Triglycerides	20.8 ± 5.9	21.4 ± 8.0	.794	29.3 ± 6.9	28.7 ± 4.7	.819
Tobacco use	21.0 ± 6.2	20.3 ± 6.0	. 777	29.6 ± 7.1	30.6 ± 7.1	.712

CVD indicates cardiovascular disease; HDL, high-density lipoprotein cholesterol; LDL, low-density lipoprotein cholesterol; M, mean; NLS, Nutritional Literacy Scale; STOFHLA, Short Test of Functional Health Literacy in Adults.

with higher BMI (*P* = .001) and prevalence of diabetes (*P* = .044) was observed in the younger (<75 years) group. Lipid profile was indistinguishable between age groups. Education did not impact BMI, blood glucose, A1C, or the prevalence of diabetes and hypertension. Nevertheless, there were differences in lipid profile, with lower education attainment (≤high school) linked to higher TC (*P* = .027) and LDL cholesterol (*P* = .023). Age and education had no influence on the small group of smokers. Both HL scales, NLS and STOFHLA, had an inverse (negative) relationship with age (*P* = .008, *P* = .002, respectively) and a direct (positive) relationship with education (*P* = .001 and *P* = .001, respectively). After adjusting for age, education level was the defining variable of HL (**Figure**).

Table 3 represents the HL scores of patients with low and high CVDRFs. Overall, there were no significant differences in NLS and STOFHLA scores between patients defined as high risk and low risk in terms of all independent CVDRF evaluated. The NLS scores of high-risk participants in relation to BMI, A1C, TC, and LDL cholesterol as risk factors were slightly higher (*P* >.05), and the same held true with STOFHLA scores. SBP and HDL cholesterol were the only risk factors that recorded higher NLS and STOFHLA scores (*P* >.05) for the low-risk group.

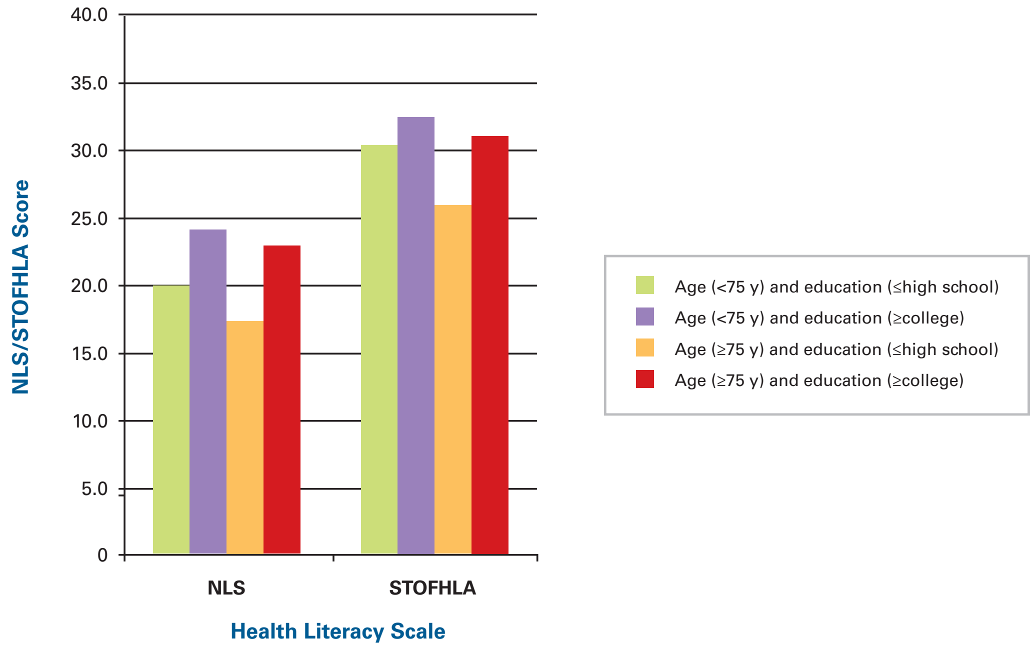
DISCUSSION

The focus of our study was to determine the HL level of elderly patients and establish whether an association exists between HL and the control of CVDRFs among a cohort of older patients seeking care at a geriatric PCMH. Since HL is more predictive of healthcare use, health risk behaviors, and health outcomes than general literacy,[16] we chose to use 2 different HL scales in this study: NLS to measure nutrition literacy, and STOFHLA to measure functional HL. Both literacy scales showed a strong positive association with education. The results are consistent with other literacy studies on older adults in America, wherein literacy proficiencies tended to increase as the education level increased. In an affluent geriatric retirement community, for instance, it was observed that years of formal education had a positive effect on HL scores.[17,18] The findings are interesting and challenge the clinical benefits of administering any of these literacy scales to the elderly, especially when the level of education of a patient—effortlessly obtainable from the history—could provide an insight into HL. Further research to confirm these results is warranted.

In keeping with the overall trend among the elderly, our sample had more women than men who were older and less educated. There was a strong inverse association between age and HL, with older individuals scoring lower. Although previous studies have also reported a negative correlation between age and HL,[19] in our research, education was the intervening variable; the direct relationship between HL and education level held true regardless of age. More research to verify these findings is necessary.

Nutrition knowledge is an important component of HL and also plays a vital role in the control of CVDRFs. In our study, older patients had a lower BMI and prevalence of diabetes, but elevated TC and LDL cholesterol were associated only with lower education attainment and not with the individual's age. These findings may be related to the fact that nutrition knowledge increases in later life with older adults reportedly having higher knowledge levels than younger adults. Furthermore, nu-

Figure. Distribution of NLS and STOFHLA Scores by Age and Education (N = 150)



NLS indicates Nutritional Literacy Scale; STOFHLA, Short Test of Functional Health Literacy in Adults.

trition knowledge has been shown to follow a trajectory similar to those of other crystallized abilities that remain strong in later life.[20,21] The results could be useful in the design and development of educational materials targeted to older patients, wherein smaller incremental increases in learning are preferred.[22]

Studies on HL and CVDRFs are quite limited. A study on an overweight and obese Turkish female population observed a correlation between educational status and CVDRFs.[23] Our results showed no significant association between HL and all CVDRFs among the elderly. These findings are similar to those obtained by Adeseun et al[24] on a younger population of dialysis patients, who reported an association of only BP— not other CVDRFs—with HL. There is a possibility that among elderly patients, many of whom are hypertensive and have been receiving care for a significant period of time, no association between BP and HL exists. Also, if there is any association between HL and CVDRFs among the younger population, this may cease to exist as the patients grow older, receive continual healthcare, and perhaps gain a better knowledge of their morbidities.

In another recent literacy and multimorbidity study, the authors observed no relationship between literacy and multimorbidity when controlling for age and family income.[25] Nevertheless, the strong positive association of HL with education level on one hand, and the lack of association with CVDRFs on the other, may have a significant implication in clinical time management of elderly. Clinical care of an elderly patient normally takes longer than that of a younger patient, and even more so if they have low HL. Therefore, on the basis of our findings, just determining whether the patient has at least a high school or above (≥12 years) level of education could not only facilitate reduction of time spent on patient evaluation but also assure the geriatric physician of maintaining quality without compromising patient care. Further research, with a larger sample population across age groups, is necessary to confirm these findings.

Limitations

The findings of this study have importance in older patient care and disease management. However, the study has limitations. Since study participation was voluntary, it is difficult to ascertain the characteristics of patients who refused to participate and the potential impact on results. Another aspect of this research is the fact that a small segment (<20%) of patients seeking care at RP-WISH were hospital or university personnel with higher education levels, which could have impacted the findings. Consequently, although the sample sociodemographics is representative of a geriatric population receiving care at a large university-affiliated inner-city PCMH, it may not be generalizable to those of other large cities. All the same, our results are interesting and merit further investigation.

CONCLUSIONS

We evaluated HL in a geriatric population receiving care at a PCMH using 2 HL scales. Among the study participants, the majority had a higher level of education (≥12 years) and an adequate level of HL as measured by NLS and STOFHLA scales. A higher education level, but not HL, appears to be predictive of a better control of CVDRFs.

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