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Adequate health literacy is associated with higher heart failure knowledge and self care confidence in hospitalized patients

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Abstract

Heart failure (HF) patients with inadequate health literacy are at increased risk for poor self care and negative health outcomes such as hospital readmission. The purpose of this study was to examine prevalence of inadequate health literacy; reliability of the Dutch HF Knowledge Scale (DHFKS) and Self Care of Heart Failure Index (SCHFI); and differences in HF knowledge, HF self care, and 30-day readmission rate by health literacy level among patients hospitalized with HF. The convenience sample included adults (N=95) admitted to a large urban teaching hospital with primary diagnosis of HF. Measures included the Short Test of Functional Health Literacy in Adults, DHFKS, SCHFI, and readmission at 30 days post-discharge. The sample was 59 ± 14 years in age, 51% male, 67% African American; 35% had less than high school education, 35% were employed, 73% lived with someone who helps with their HF care, and 16% were readmitted within 30 days of index admission. Health literacy was inadequate for 42%, marginal for 19%, and adequate for 39%. Reliability of the DHFKS and SCHFI scales was comparable to prior reports. Mean knowledge score was 11.43 ± 2.26, SCHFI subscale scores were 56.82 ± 17.12 for maintenance, 63.64 ± 18.29 for management, and 65.02 ± 16.34 for confidence. Those with adequate health literacy were younger and had higher education level, HF knowledge scores, and HF self care confidence compared to those with marginal or inadequate health literacy. Self care maintenance and management scores and 30-day readmission rate did not differ by health literacy level. These findings demonstrate the high prevalence of inadequate and marginal health literacy and that health literacy is an important consideration in promoting HF knowledge and confidence in self care behaviors, particularly among older adults and those with less than high school education.

Keywords

heart failure; self care; knowledge; health literacy

Introduction

Heart failure (HF) is a major public health problem which affects over 5.7 million Americans and costs \$37.2 billion annually.¹ HF morbidity is reaching epidemic proportions

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and African Americans are disproportionately affected.¹⁻³ Repeat emergency room visits and rehospitalization for symptom relief contribute to HF being the most costly cardiovascular illness in the US.^{1, 4, 5} Common reasons for HF rehospitalization include delays in symptom recognition, medication and dietary noncompliance, and lack of knowledge and skills for competent self care.⁶⁻⁸ A recent American Heart Association (AHA) scientific statement identified low health literacy as a challenge to effective self-care⁹ and the AHA and the Heart Failure Society of America have recommended further investigation of the effect of health literacy on self-care.^{9, 10}

Health literacy has been defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions.¹¹ Health literacy is a shared function of social and individual factors and health literacy skills are mediated by education, culture, and language.¹² Patients with low health literacy have trouble processing items that affect disease management such as understanding educational materials, reading appointment papers, and reading medication labels,¹³⁻¹⁶ and may also experience difficulties comprehending oral communication from their health care provider.^{14, 15, 17}

Those with low health literacy are 1.5 – 3 times more likely to experience adverse health outcomes.¹⁸ Individuals with inadequate health literacy and chronic conditions such as HF are at increased risk for poor care and outcomes including lack of knowledge about disease,¹⁹⁻²¹ poor self care,^{22, 23} increased hospital admissions,¹⁷ and increased mortality.²⁴

Among those with HF, health literacy scores have been associated with education and cognitive ability, and were significantly lower in African American males, older adults, and patients with comorbidities.²⁵ Murray (2009) also reported that risk of HF-related readmission was significantly higher among those with inadequate health literacy, even after controlling for clinically relevant risk factors.²⁶ In another study among HF patients, Kollipara (2008) reported that 41% of the patients had low sodium knowledge and the risk of readmission was significantly higher among those with low sodium knowledge scores.²⁷

The primary aims of this study were to 1) determine the prevalence of inadequate health literacy and 2) determine the reliability of the Dutch Heart Failure Knowledge Scale (DHFKS) and Self Care of Heart Failure Index (SCHFI) in this population. A secondary aim of this study was to examine the differences by level of health literacy in sociodemographic characteristics, HF knowledge, HF self care, and 30-day readmission rate among patients hospitalized with HF.

Methods

Study design and sample

This descriptive, comparative study was conducted in a large urban teaching hospital. Eligible inpatients were over the age of 18 years, hospitalized with primary diagnosis of HF, and community-dwelling prior to admission (i.e., not in a long-term care facility). Those unable to speak or understand English, with severe renal insufficiency requiring dialysis, or an acute myocardial infarction within 30 days prior to admission were excluded. In addition, patients on contact, droplet, and airborne precautions were excluded.

Potential participants were referred to the study team by the hospital's HF care coordinator, an advanced practice nurse. Trained research assistants contacted the referred patients' bedside nurse to ensure availability before approaching the patient to ask if they would like to participate. All patients were hospitalized for at least 24 hours and had received standardized HF education from the hospital's HF care coordinator prior to being contacted.

Data collection

After verbal consent was obtained, instruments assessing sociodemographics, health literacy, HF knowledge, and HF self care behaviors were administered. Participants were given the large print version of reading passages for the S-TOFHLA and were instructed to complete as much of the health literacy measure as possible in the allotted time (7 minutes) as per standardized instructions. All other measures were administered orally by trained research assistants, who gave participants the opportunity to follow along using a set of laminated cards containing each of the items and response options. The battery of instruments required approximately 45 minutes for participants to complete. Data collected were shared with the HF Care Coordinator and used for clinical care purposes. This study was approved by the institutional review board.

Measurements included sociodemographic information (i.e., age, gender, race, highest educational level attained, estimated annual household income, insurance status), Dutch Heart Failure Knowledge Scale (DHFKS), Self Care of Heart Failure Index (SCHFI), and Test of Functional Health Literacy in Adults, Short-form (S-TOFHLA). The DHFKS is a 15-item multiple-choice scale that has been shown to be a reliable and valid measure of patient's HF knowledge.²⁸ The scale assesses knowledge related to HF symptom recognition, diet, fluid restriction, medication compliance, and exercise regimen. HF self care was measured using the 22-item SCHFI, with subscales assessing self care maintenance, self care management, and self care confidence. Scores on each of these scales are standardized to a 0–100 range, with scores of 70 and above used to determine self care adequacy. Construct and discriminant validity have been demonstrated for the SCHFI; reliability coefficients were adequate for the confidence subscale (0.84), though lower than desired for management (0.59) and maintenance (0.54) subscales.²⁹ The S-TOFHLA is a 36-item instrument to assess reading comprehension of health-related material. Scores are categorized as inadequate (0–16), marginal (17–22), or adequate (23–36). Although it does not address the full complexity of the health literacy construct, the S-TOFHLA is widely used in the assessment of health literacy and has been shown to be a reliable and valid measure of reading comprehension in the healthcare setting.³⁰ Left ventricular ejection fraction (LVEF) was obtained via medical record review.

Statistical analysis

Descriptive statistics of participant sociodemographic characteristics, HF knowledge, HF self care, and health literacy were calculated. Cronbach's alpha was calculated to assess internal consistency (reliability) of the DHFKS and SCHFI in this sample. Pearson's correlation was calculated to determine bivariate relationships between study variables. Chi-square analyses were conducted to examine differences among health literacy levels for categorical variables (i.e., education level, readmission at 30 days). Three-way ANOVA with post hoc pairwise comparisons using Fisher's test of least significant differences (LSD) was conducted to examine differences among health literacy levels for continuous variables (i.e., age, HF knowledge, HF self care). SPSS (version 16) was used for all analyses.³¹

Results

A total of 172 eligible HF patients were approached during hospitalization and asked to participate in this study. Of those, 55% (n=95) agreed to participate and completed all questionnaires. Sociodemographic characteristics of the sample are presented in Table 1. Participants' mean age was 59 years and half (51%) were male. A majority of participants were African American (67%), had at least high school education (65%), lived with others (84%), reported annual household income of \$30,000 or more (57%), had health insurance (93%), and reduced LVEF <40% (55%). Reliability, measured via Cronbach's alpha, for the

DHFKS and SCHFI in this sample (Table 2) was comparable to values reported by scale authors.

Health literacy was inadequate (n=40; 42%) or marginal (n=18; 19%) for most participants and adequate for 39% (n=37). Bivariate analysis showed that level of health literacy was significantly correlated with age ($r = -.352, p < .001$), education level ($r = .245, p = .017$), and HF knowledge ($r = .465, p < .001$). Individuals with adequate health literacy were significantly younger (mean age 54.16 ± 14.53) than those with inadequate (mean age 65.03 ± 12.33) or marginal health literacy (mean age 57.22 ± 12.31), $p = .002$. Education differed significantly by health literacy level; participants with at least high school education had higher health literacy ($X^2 = 8.99, p = .011$).

HF knowledge, self care, and 30-day readmission rate by health literacy level are presented in Table 3. Knowledge scores differed significantly by health literacy level ($F(2, 92) = 12.7, p < .001$). Post-hoc pairwise comparisons showed individuals with inadequate health literacy (mean=10.30) had significantly lower HF knowledge scores than those with either marginal (mean=11.50, $p = .039$) or adequate (mean=12.62, $p < .001$) health literacy, although there was no significant difference in knowledge scores between those with marginal and adequate health literacy ($p = .056$).

Self care confidence scores varied significantly by level of health literacy ($F(2, 92) = 5.73, p = .005$), and were lowest among individuals with marginal health literacy. In post-hoc pairwise comparisons, those with adequate health literacy had significantly higher self care confidence (mean=70.78) than those with marginal health literacy (mean=55.91, $p < .001$), though there was no significant difference between participants with adequate and inadequate health literacy ($p = .053$) or between marginal and inadequate health literacy groups ($p = .078$). Participants with marginal health literacy also had the highest 30-day readmission rate, although this trend was not statistically significant ($p = .116$).

Discussion

In this sample of adults with acute HF exacerbation, 39% of participants had adequate health literacy. This rate is much lower than the 54% rate found in pooled analysis of health literacy studies in the United States³² and 72%²⁵ and 73%²⁰ prevalence rates in two samples of ambulatory heart failure patients, but comparable to the 40% rate identified in a diverse (64% Hispanic, 22% African-American) urban, cardiovascular inpatient sample.³³ It is unlikely that the low rate in the current study was due to age, since this sample had a lower mean age (59 years) than that found in ambulatory heart failure studies (63 years²⁵ and 65 years²⁰) and age was negatively correlated with adequate health literacy in this and other studies.³² Alternatively, the low rate could be attributed to the high percentage of African-Americans,^{32, 34} although this study found no significant correlation between race and health literacy. Instead, the fact that the rate is comparable to that found in a similar urban, cardiovascular inpatient setting³³ indicates that these disparate prevalence rates across samples may be attributable to the presence of chronic disease. One population-based cross-sectional study (n=2923) demonstrated an association between low health literacy and HF prevalence,²³ though a smaller study found the relationship was attenuated after controlling for education.²⁰ Unfortunately, disentangling the inter-relationships among HF, health literacy, education and race is not possible with the current cross-sectional literature,³⁵ due to the complexity of relationships between African-American race and low level of education with increased risk of HF^{36, 37} and low literacy.^{36, 37} Health literacy and level of education

Despite uncertainty of causal pathways, education and health literacy are both areas that can be addressed in interventions and, thus, warrant further discussion. Educational achievement was positively correlated with health literacy in this study and in prior work,^{20, 23, 25} including a nationally representative study of over 19,000 adults (the National Assessment of Adult Literacy).³⁴ Education is a proxy for socioeconomic status, and income has been correlated with health literacy,^{20, 34} though this relationship is not consistent in adjusted analyses and was not noted in this analysis.^{25, 32} However, when multivariate models have included both education and income, education continued to be significantly correlated with health literacy, indicating that it is an independent predictor of health literacy.^{20, 38} This may be due to the cascading effect of education on a plethora of social and cognitive factors. In addition to enhancing general literacy and communication skills necessary to obtain health information,³⁹ education increases cognitive skills, including the ability to process information, reason,⁴⁰ and problem-solve that are critical to the health literacy construct.¹² Also, education fosters psychosocial factors, such as self-efficacy, which is a potential mediator of health literacy and self-care for chronic disease.^{35, 41} Further longitudinal studies investigating the impact of education may help identify potential areas for intervention, particularly among individuals with less than high school education who appear to be at highest risk of low health literacy.³⁴

Health literacy and disease-specific knowledge

An important finding in this study is the positive correlation between level of health literacy and HF knowledge, which is consistent with another study of HF patients in an outpatient setting.¹⁹ Prior work has also suggested relationships between level of health literacy and sodium knowledge in HF patients²⁷ and medication knowledge in adults.^{42, 43} Additionally, research in other chronic conditions, including hypertension and diabetes, established parallel associations of health literacy and disease-related knowledge.^{19, 44} Therefore, interventions to enhance both HF knowledge and health literacy skills are needed for HF patients. Interventions will likely need to address HF knowledge via educational materials and self care support tools tailored to level of health literacy as a means of enhancing self care.⁴⁵

Research by Koelling and colleagues (2005) found that hospitalized HF patients receiving an hour-long one-on-one educational session prior to discharge reported better compliance with self care behaviors at 30 days and had lower rehospitalization and mortality rates at 180 days compared to those who received only a folder of standard written discharge information.⁴⁶ Overall, HF knowledge scores (mean 10.3–12.6 across health literacy strata) in the current sample were above the level considered to be adequate (>10),⁴⁷ but lower than ideal for individuals who recently received standardized in-hospital HF education. This may be attributable to common HF symptoms, such as mild cognitive impairment⁴⁸ or fatigue,^{49, 50} that could hinder patients' ability to acquire knowledge. Alternatively, it may simply reflect low disease-specific knowledge prior to hospitalization among HF patients,⁵¹ which is not likely to be susceptible to remediation with a single session of education.⁵² Although our study was not designed to test the in-hospital educational intervention, this finding suggests that inpatient education alone is not sufficient to achieve high levels of HF knowledge. Unfortunately, despite the evidence of benefits of nurse-delivered outpatient HF education interventions,^{53, 54} there is still a lack of evidence on the effectiveness of inpatient HF education. While both the Joint Commission and ACC/AHA Performance Measures require documentation of discharge instructions encompassing six key areas of care (discharge medications, diet, weight monitoring, activity level, follow up, what to do if symptoms worsen), they may not accurately reflect the extent of the education, how the information was conveyed (i.e. verbal instructions in addition to written materials or the reading level of written materials), or, perhaps most importantly, the depth of the patient's

understanding.^{55, 56} Such important missing information may help explain discrepancies among studies examining the relationship between compliance with performance measures and patient clinical outcomes.^{57, 58}

Health literacy and self care

Although health literacy was thought to be positively correlated with self care behavior,⁵⁹ and despite calls for further research,^{9, 10} this is the first study to our knowledge to examine the relationship of health literacy with multiple components of self care in HF patients. Similar to knowledge scores, mean self care scores were below adequate level (considered to be ≥ 70),²⁹ with the exception of mean self care confidence score among those with adequate health literacy (70.8). In particular, the mean self care maintenance score in this study (56.8) was much lower than other published findings, which ranged from 63 to 78.^{29, 60–64} Due to numerous barriers to self care,⁶⁵ multiple unmeasured factors could potentially account for these low values. However, we can infer that health literacy may not predict self care behavior, since self care management and maintenance did not follow expected patterns across health literacy strata and there was considerable within-strata score variance. Although this null relationship may appear counter-intuitive, research in diabetes has also failed to demonstrate a relationship between health literacy and self care.^{66–68} Although it would be interesting to repeat this analysis in samples with higher overall scores, it is possible that health literacy truly has no relationship with self care management and maintenance, or that individuals with low health literacy develop compensatory strategies for self care.

In this sample, patients with marginal health literacy had lower self care confidence scores than those with inadequate health literacy. This paradoxical finding, though it warrants replication in other studies, may be attributable to higher expectations for individuals with marginal health literacy. In other words, since health literacy is a product of individual factors and environmental characteristics,^{12, 35} a mismatch of environmental resources and health literacy ability may result in unmet needs and decreased self care confidence. For example, if patients with marginal health literacy are perceived by care providers to have adequate health literacy, individuals may not be receiving the support and resources needed to independently manage their health. Regardless of the etiology, this finding demonstrates the potential for adverse consequences for both inadequate and marginal health literacy, and highlights the need for tailored intervention at either level.

Health literacy and readmission

There was no significant relationship between health literacy and readmission in this study as noted in prior work,^{17, 22, 26} which may be attributable to the low rates of readmission overall in this study. In one study of 3,260 community-dwelling older adults with chronic illness, the effect of health literacy on hospitalization was greater for those in good physical health, but not significant for patients with physical health levels below the mean.¹⁷ Therefore, the acuity of illness of the participants of this study may have functioned as a covariate in the relationship between health literacy and readmission.

Study limitations

This study has several limitations, including a relatively small sample size. This study may have been limited by convenience sampling, though our sampling frame in a large, teaching institution allowed us to target a population at highest risk for HF (i.e., male, African-American, less than high school education)^{36, 37} which has previously been under-represented in both the HF health literacy and HF self care literature.^{20, 25, 29, 33, 51, 60–64} Furthermore, sample diversity was enhanced by including patients throughout the hospital, since study referral was provided by the HF coordinator. This study sampled individuals

who were admitted with acute HF, which may pose two limitations. First, this may have created selection bias, since low health literacy has been associated with HF hospitalizations,⁶⁹ though a rationale can be made for targeting this at-risk population. Second, acute exacerbation of HF may have worsened the cognitive status of participants, which may influence health literacy level.²⁵ Although all participants in this study were grossly cognitively intact, no formal assessment for cognitive status was included. In addition, although multivariate analysis of both health literacy and heart failure self care may yield novel findings in this population, this sample size relative to the multi-faceted nature of the constructs precluded such analysis.

Another limitation common to all studies of health literacy is incomplete assessment of health literacy, since no current measure of health literacy addresses the complex social and cultural factors that are encompassed by the construct.¹² That is, many individuals may be able to read instructions, but still have difficulty comprehending sophisticated medical care or understanding the complexities of managing their health given their personal situation. The S-TOFHLA, which was used in this study, does not assess numeracy skills, though it creates less participant burden than instruments that do assess numeracy. Also, unlike shorter screeners, it is able to discriminate between inadequate and marginal levels of health literacy.

Implications

These findings and the growing body of literature on health literacy have significant clinical implications. The 2004 Institute of Medicine report highlighted the urgent need to address low health literacy to improve health outcomes,¹² and the World Health Organization (WHO) report on social determinants of health highlighted the relationship between health literacy and health disparities.⁷⁰ The comparatively low rates of health literacy and self care in this at-risk population add urgency to the recommendations of those reports for patients with HF. The results of this study highlight the need to identify populations such as these that face increased risk for HF and other chronic diseases as well as inadequate self care and inadequate or marginal health literacy, to target interventions accordingly.

The results of this study, coupled with other findings, point to the need to tailor interventions to improve HF knowledge and self care among individuals with HF. Clinicians should consider level of health literacy when addressing patients and providing health information to patients and families. This, of course, will require a timely, standardized approach to measurement of health literacy.¹⁰

Furthermore, the negative correlation of age with level of health literacy, in this and numerous other studies,^{20, 25, 33, 38} raises particular concerns about health literacy among older adults. This population faces the greatest burden of chronic illness and commonly experience polypharmacy. Therefore, this population which is likely to have the greatest need for health knowledge and health literacy may be less able to comprehend the information, when compared with younger populations. Thus, clinicians should pay particular attention to health literacy level when preparing and delivering health education information for older adults.

In addition to individually-tailored interventions, multi-level interventions are needed to meet the needs of patients with low health literacy. At a policy level, educational policies have potential to indirectly improve health literacy by improving cognitive and psychosocial factors and empowering individuals⁷¹ and health policies may increase resources available to individuals with inadequate health literacy. Health delivery systems and health information systems need to adapt to fully assess and respond to inadequate health literacy in clinical practice and public health settings to identify populations at risk for low health

literacy, while avoiding stigmatization or embarrassment.¹² For example, protocols for health literacy screening should be developed and education for health care providers on health literacy is needed. In particular, targeted health literacy screening of individuals with less than a high school education may be warranted.³⁴ In addition, research investigating health literacy in HF patients, including longitudinal studies investigating mechanisms of disparities and interventional research to address health literacy and self care, are needed to guide the development of effective strategies and tools to tailor and thereby improve the knowledge, self care, and outcomes of HF patients.

What is New?

Adequate health literacy is associated with higher heart failure knowledge and self care confidence in hospitalized patients

- Health literacy was inadequate (42%) or marginal (19%) for the majority of hospitalized HF patients in this sample.
- Reliability of the Dutch Heart Failure Knowledge Scale and Self Care in Heart Failure Index scales was comparable in this sample to prior reports.
- Those with adequate health literacy were younger and had higher education level, HF knowledge scores, and HF self care confidence compared to those with marginal or inadequate health literacy.
- Health literacy is an important consideration in promoting HF knowledge and self care, particularly among older adults and those with less than high school education

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Table 1

Sociodemographic Characteristics (N=95)

	Total Sample N=95	Level of Health Literacy			p*
		Inadequate N=40	Marginal N=16	Adequate N=35	
Age in years, mean±SD (median)	59±14 (61)	65±12 (65)	57±12 (60)	54±15 (58)	.002
Female, %	49	50	39	54	.571
Race, %					.800
African-American	68	70	61	68	
White/Other [†]	33	30	39	33	
Education Level, %					.035
Less than High School	35	45	44	19	
≥High School	65	55	56	81	
Employment Status, %					.102
Employed (Full/Part-Time)	35	23	44	43	
Retired/ Disability/ Unemployed	65	77	56	57	
Estimated Annual Household Income [‡] , %					.296
< \$30,000	28	30	28	27	
≥ \$30,000	57	50	50	68	
Insurance Status, %					.589
Uninsured	7	5	6	11	
Insured	93	95	94	89	
Type of Insurance, %					.175
Private	35	24	40	46	
Medicare/Medicaid	51	66	47	36	
Private and Medicare	14	10	13	18	
Married, %	34	33	33	35	.970

	Level of Health Literacy				p*
	Total Sample N=95	Inadequate N=40	Marginal N=16	Adequate N=35	
Lives with Others, %	84	80	89	87	.615
Lives with Someone Helping with HF, %	73	70	73	76	.855
LVEF, %					
< 40	55	55	61	51	.792
≥ 40	45	45	39	49	

* p value for comparison of inadequate, marginal, and adequate health literacy groups

† other (N=3)

‡ Percentages do not add up to 100% due to some participants declining to provide annual income

Table 2

Reliability of Dutch Heart Failure Knowledge Scale (DHFKS) and Self Care in Heart Failure Index (SCHFI)

	Cronbach's α	
	Hospitalized HF patients (current study sample)	Reported by scale authors
DHFKS	.58	.62 ²⁶
SCHFI Maintenance Subscale	.72	.54 ²⁷
SCHFI Management Subscale	.56	.59 ²⁷
SCHFI Confidence Subscale	.76	.84 ²⁷

Table 3

HF Knowledge and Self Care by Health Literacy Level

	Total Sample N=95	Health Literacy Level			p*
		Inadequate N=40	Marginal N=18	Adequate N=37	
HF Knowledge, mean (SD)	11.4 (2.3)	10.3 (2.2)	11.5 (2.3)	12.6 (1.7)	<.000
HF Self Care Maintenance, mean (SD)	56.8 (17.1)	59.0 (15.6)	57.4 (14.2)	54.2 (19.7)	<.463
HF Self Care Management, mean (SD)	63.6 (18.3)	61.5 (13.0)	64.7 (18.9)	65.6 (22.9)	<.613
HF Self Care Confidence, mean (SD)	65.0 (16.3)	63.8 (12.5)	55.9 (18.0)	70.8 (17.2)	<.005
Readmission within 30d, %	16	8	28	19	<.117

* p value for comparison of inadequate, marginal, and adequate health literacy groups