

Health Literacy and Outcomes in Patients With Heart Failure: A Prospective Community Study

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Abstract

Objective: To examine the impact of health literacy on hospitalizations and death in a population of patients with heart failure (HF).

Patients and Methods: Residents from the 11-county region in southeast Minnesota with a first-ever *International Classification of Diseases, Ninth Revision* code 428 or *Tenth Revision* code 150 (n=5121) from January 1, 2013, through December 31, 2015, were identified and prospectively surveyed to measure health literacy using established screening questions. A total of 2647 patients returned the survey (response rate, 52%); 2487 patients with complete health literacy data were retained for analysis. Health literacy, measured as a composite score on three 5-point scales, was categorized as adequate (≥ 8) or low (< 8). Cox proportional hazards regression and Andersen-Gill models were used to examine the association of health literacy with mortality and hospitalization.

Results: Of 2487 patients (mean age, 73.5 years; 53.6% male [n=1333]), 10.5% (n= 261) had low health literacy. After mean \pm SD follow-up of 15.5 ± 7.2 months, 250 deaths and 1584 hospitalizations occurred. Low health literacy was associated with increased mortality and hospitalizations. After adjusting for age, sex, comorbidity, education, and marital status, the hazard ratios for death and hospitalizations in patients with low health literacy were 1.91 (95% CI, 1.38-2.65; $P < .001$) and 1.30 (95% CI, 1.02-1.66; $P = .03$), respectively, compared with patients with adequate health literacy.

Conclusion: Low health literacy is associated with increased risks of hospitalization and death in patients with HF. The clinical evaluation of health literacy could help design interventions individualized for patients with low health literacy.

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Heart failure (HF) is a public health burden.^{1,2} In the United States, there are an estimated 5.7 million people living with HF, with total annual medical costs of \$31 billion.^{1,3,4} These numbers are expected to grow to more than 8 million people and \$70 billion in cost by 2030.⁴ Although diagnosis and treatment have improved, mortality has not changed,²⁻⁵ and hospitalizations are still common, most often due to comorbidities.⁶⁻⁹ Because the management of HF is complex and requires multiple skills, to prevent poor outcomes, it is crucial for patients to be engaged in good self-care.^{10,11}

Health literacy is described by the Institute of Medicine 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.”¹² Patients with limited health literacy have insufficient

drug adherence and inadequate self-care behavior.^{13,14} Thus, these patients may use more health care services such as hospital or emergency department visits¹⁵ and, as a consequence, incur higher medical costs.¹⁶ In HF, associations between poor health literacy and mortality,^{17,18} hospitalization,^{19,20} and recurrence of HF²¹ have been reported. However, these results were generated in smaller convenience samples, chiefly of hospitalized patients, relying on composite end points (death and hospitalizations combined). Hence, to our knowledge, health literacy remains to be studied in a large population-based community, a design essential to comprehensively capture outcomes and afford separate analyses for death and hospitalizations, which have vastly different clinical implications.

To address this gap in knowledge, we investigated the association between health literacy and death and hospitalizations in a large



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population-based study of patients with HF in southeast Minnesota.

METHODS

Study Setting and Design

This study was conducted in 11 counties in southeast Minnesota: Dodge, Fillmore, Freeborn, Goodhue, Houston, Mower, Olmsted, Rice, Steele, Wabasha, and Winona (approximate population of 491,684 according to the 2010 US Census), incorporating data from Mayo Clinic, Mayo Clinic Health System, and Olmsted Medical Center and their affiliated clinics. This study used the medical records linkage system of the Rochester Epidemiology Project (REP), which allows retrieval of health care utilization and outcomes of the residents in this region.²²⁻²⁴ The study was approved by the Mayo Clinic and Olmsted Medical Center institutional review boards.

Case Identification

Using the resources of the REP, residents 18 years or older from the 11-county area in southeast Minnesota with a first-ever *International Classification of Diseases, Ninth Revision* code 428 or *Tenth Revision* code I50 for HF from January 1, 2013, through December 31, 2015, were identified. These patients were asked to complete a survey to measure health literacy and other sociobehavioral measures. A mixed-mode design was used to improve the response rate. Patients were mailed a survey packet containing the survey, an introductory letter, and a Health Insurance Portability and Accountability Act of 1996 form. Patients who did not want to complete the survey through the mail were given the opportunity to complete the survey over the telephone by requesting a telephone call. The survey packet was resent to nonresponders approximately 1 month after the first mailing. A telephone interview was attempted approximately 1 month after the second mailing for the remaining nonresponders.

Health Literacy

Health literacy was measured using 3 established screening questions: (1) How confident are you filling out forms by yourself? (2) How often do you have someone (such as a family member, friend, hospital/clinic worker, or caregiver) help you read hospital materials?

(3) How often do you have problems learning about your medical condition because of difficulty reading hospital materials?^{25,26} Each question is scored on a 5-point scale. The sum of the 3 question scores can range from 3 to 15 points, with a lower score indicating lower health literacy. These 3 questions have been validated against longer and more comprehensive measures of health literacy.²⁶⁻²⁸ The Cronbach α , a measure of internal consistency reliability, for the 3 questions was 0.80 in this study, which supports scoring and reporting them as a single measure. Patients were categorized as having low health literacy if they scored less than 8 and adequate health literacy if they scored 8 or greater.

Other Patient Characteristics

Educational level and marital status were obtained from the patient survey. The comorbidities included in the Charlson Comorbidity Index were retrieved using the electronic REP record linkage system, and the score was calculated for each participant.^{29,30}

Outcomes

Participants were followed for death and hospitalization from enrollment through December 31, 2016 (range of follow up, 9-21 months). Death information was retrieved from the REP, which obtains death certificate data from Minnesota. Hospitalizations were collected through the REP, which, as described previously herein, collects information for nearly all hospitalizations for residents in the 11 counties included in this study. In-hospital transfers were counted as a single event.

Statistical Analyses

Participant characteristics, overall and by health literacy category, are presented as frequencies or mean \pm SD. Differences between individuals with low vs adequate health literacy were compared using 2-sample *t* tests for continuous variables and χ^2 tests for categorical variables. Mortality was assessed using the Kaplan-Meier method according to health literacy categories and compared with the log-rank test. Cox proportional hazards regression was used to estimate the associations of health literacy with death in unadjusted, age- and sex-adjusted, and fully adjusted models that

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