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Associations Between Seattle Heart Failure Model Scores and Medical Resource Use and Costs: Findings From HF-ACTION

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Abstract

Background—Prognostic models, such as the Seattle Heart Failure Model (SHFM), have been developed to predict patient survival. The extent to which they predict medical resource use and costs has not been explored. In this study, we evaluated relationships between baseline SHFM scores and 1-year resource use and costs using data from a clinical trial.

Methods and Results—We applied generalized linear models to examine the relative impact of a 1-unit increase in SHFM scores on counts of medical resource use and direct medical costs at 1 year of follow-up. Of 2331 randomized patients, 2288 (98%) had a rounded integer SHFM score between −1 and 2, consistent with predicted 1-year survival of 98% and 74%, respectively. At baseline, median age was 59 years, 28% of patients were women, and nearly two-thirds of the cohort had New York Heart Association class II heart failure and one-third had class III heart failure. Higher SHFM scores were associated with more hospitalizations (rate ratio per 1-unit increase, 1.86; $P < .001$), more inpatient days (2.30; $P < .001$), and higher inpatient costs (2.28; $P < .001$), outpatient costs (1.54; $P < .001$), and total medical costs (2.13; $P < .001$).

Conclusion—Although developed to predict all-cause mortality, SHFM scores also predict medical resource use and costs.

Trial Registration—clinicaltrials.gov Identifier: NCT00047437.

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Keywords

Health Care Costs; Health Resources; Health Status; Heart Failure; Questionnaires; Risk Assessment

Introduction

The direct and indirect costs of heart failure in the United States were estimated at more than \$39.2 billion in 2010.¹ Heart failure primarily affects older persons and is the leading cause of hospitalization in persons 65 years and older. Approximately 1 in 5 Medicare beneficiaries hospitalized for heart failure requires additional inpatient care within 30 days after discharge.² An analysis of Medicare data revealed that typical inpatient care costs for a patient with severe heart failure were approximately \$24,000 per year, compared to about \$3000 for a typical Medicare beneficiary.³

To facilitate assessment of the costs and efficiency of disease management programs for heart failure, our group is developing a Web-based probabilistic disease simulation model that researchers and health care managers can use to evaluate the cost-effectiveness of specific heart failure disease management programs. The Seattle Heart Failure Model (SHFM), developed and externally validated in several large cohorts, is integrated into this model to predict survival based on clinical characteristics, evidence-based treatments, and laboratory measures.⁴⁻⁶ We sought to evaluate whether the SHFM could also be used to predict medical resource use and thereby estimate direct medical costs.

Data from a recently completed large-scale clinical trial of exercise training in outpatients with heart failure provided an opportunity to use the prospectively collected clinical data to examine these relationships.⁷ We hypothesized that patients with heart failure and higher SHFM scores incurred more hospitalizations and inpatient days and higher medical costs than patients with lower SHFM scores.

Methods

Study Population

The Heart Failure: A Controlled Trial Investigating Outcomes of Exercise Training (HF-ACTION) trial randomly assigned patients to an exercise training program plus usual care or to usual care alone.⁷ Between April 2003 and February 2007, 2331 patients were enrolled from 82 study sites in the United States (n = 2068), Canada (n = 188), and France (n = 75) for a median follow-up period of 2.5 years. The trial collected a wide range of data on patients' clinical and treatment characteristics and laboratory measures. It demonstrated that exercise training was safe and produced nonsignificant reductions in the primary end point, a composite of all-cause mortality or all-cause hospitalization, which was observed in 65% of patients randomly assigned to receive exercise training and usual care vs 68% of patients assigned to receive usual care alone (hazard ratio [HR], 0.93; 95% CI, 0.84 to 1.02; *P* = .13).⁸ The economic evaluation demonstrated that measures of resource use and costs were similar between the groups, and the total direct medical costs per participant were estimated

at \$50,857 (SD, \$81,488) in the exercise group and \$56,177 (SD, \$92,749) in the usual care group (95% CI for the difference, -\$12,755 to \$1547; $P = .10$).⁹

Seattle Heart Failure Model Scores

The SHFM incorporates 20 variables representing patients' demographic, clinical, and treatment and laboratory characteristics. Of these, 3 variables (ie, lymphocytes, uric acid, and allopurinol use) were not collected in HF-ACTION. To compute the SHFM scores, we generated patient-level predicted values for lymphocytes and uric acid using regression models developed using the original SHFM cohort,⁴ and we assumed no allopurinol use. For patients with missing laboratory values for cholesterol (35%), hemoglobin (24%), or sodium (11%), we imputed the data using mean values from HF-ACTION participants with nonmissing data. SHFM scores for HF-ACTION participants were generated using the original published equation.⁴ We limited the analysis to patients with a rounded SHFM score between -1 and 2.

Medical Resource Use and Costs

The HF-ACTION case report form was designed to collect extensive medical resource use data every 3 months for the first 2 years of follow-up and yearly thereafter for all participants. Medical resources included all-cause hospitalizations, including length of stay and inpatient procedures performed, urgent and emergent care visits, and nonurgent outpatient visits and procedures.

Although data on medical resource use were collected beyond 1 year, we chose to examine relationships between SHFM scores and resource use in the first year of follow-up only to reduce variance attributable to changes in patients' prognoses (ie, higher SHFM scores) over time. The costing methods were described in detail previously.⁹ As part of the economic evaluation, hospital billing data were collected for more than 80% of hospitalizations and emergency department visits that occurred during the follow-up period. We converted department-level hospital charges to costs using department-specific cost-to-charge ratios derived from each hospital's annual Medicare cost report. For hospitalizations without available bills, we imputed costs by multiplying the length of stay for each hospitalization by estimates of median daily costs that corresponded to 1 of 47 potential reasons for hospitalization. To avoid overestimating costs for procedure-based stays typically characterized by high costs and short stays (eg, percutaneous coronary revascularization and device implant), we assigned the median total costs associated with hospitalizations for these procedures. Then, for patients with stays that extended beyond the median length of stay for each procedure type, we applied the median daily cost for heart failure, \$1202, to all remaining hospital days. We used the 2008 Medicare Physician Fee Schedule to assign costs for physician services, including inpatient services, outpatient visits, and inpatient and outpatient procedures. For hospitalizations that continued beyond the 1-year time horizon for the analysis, we calculated the daily cost of inpatient care by dividing the total inpatient cost by the length of stay for the admission and summed daily costs incurred up to 1 year beyond randomization. For emergency department visits without available bills, we applied the median cost calculated from the available bills, \$479, as a proxy. We valued all costs in 2008 US dollars.

Statistical Analysis

For reporting purposes, we rounded SHFM scores to the nearest integer and grouped patients accordingly. We present baseline demographic and clinical variables and 1-year medical resource use and costs for each group. We report frequencies and percentages for categorical variables and means and SDs for continuous variables. We used means and SDs to describe counts of medical resource use and costs during the first year of follow-up. Given the right-skewed distributions of resource use and costs, we also report medians and interquartile ranges.

In the statistical analysis, we analyzed SHFM score as a continuous variable. We used analysis of variance to evaluate relationships between categorical baseline variables and continuous SHFM scores and Pearson correlation tests to evaluate relationships between continuous baseline variables and SHFM scores. We applied generalized linear models to evaluate relationships between SHFM scores and medical resource use and costs during the first year of follow-up. Specifically, we applied logit links and binomial error distributions to model the proportions of patients who used each type of medical resource. We applied log links and negative binomial error distributions to examine the relative associations between SHFM scores and 1-year counts of medical resource use. We applied log links and gamma error distributions to model 1-year medical costs. In each of the models, we included an offset variable to adjust differential follow-up periods in the first study year. We also performed a sensitivity analysis of costs in which we excluded patients who died during the first year of follow-up. We used SAS version 9.2 (SAS Institute, Cary, North Carolina) for all analyses.

Results

Among the 2331 patients randomly assigned in HF-ACTION, SHFM scores were available for 2293 (98%), of whom 5 (0.2%) had a rounded SHFM score greater than 2 and were excluded from subsequent analyses. Table 1 shows the baseline characteristics of the 2288 patients in the final study cohort. The mean baseline SHFM score was 0.24 (SD, 0.64; median, 0.18; interquartile range, -0.20 to 0.63), corresponding to a predicted 1-year survival of 95%. When we rounded the SHFM scores to the nearest integer, 11.5% of patients had a score of -1, 57.3% had a score of 0, 27.1% had a score of 1, and 3.9% had a score of 2, corresponding to predicted 1-year mortality of 1.5%, 4.0%, 10.5% and 26.0%, respectively. At 1 year, 92.4% of patients were alive and participating, 4.7% had died, and 2.8% had discontinued participation.

Patients with higher SHFM scores were more likely to be men ($P < .001$) and white ($P = .02$). Ninety-one percent of patients with a rounded SHFM score of 2 were men, compared with about 67% of patients with a score of -1 ($P < .001$). Higher SHFM scores were significantly associated with older age, worse New York Heart Association (NYHA) functional classification, lower ejection fraction, lower systolic and diastolic blood pressure, and lower hemoglobin. Patients with higher SHFM scores were significantly more likely to be hospitalized ($P < .001$) and to have had an emergent or urgent outpatient visit ($P < .001$) (Table 2). The mean number of hospitalizations during the first year after randomization ranged from 0.4 among patients with predicted 1-year mortality of 1.5% (rounded SHFM

score, -1) to 1.5 among patients with predicted 1-year mortality of 26% (rounded SHFM score, 2). The mean number of inpatient days ranged from 2.1 to 11.4 days, respectively. Higher SHFM scores were significantly associated with more hospital admissions and more inpatient days; a 1-unit increase in SHFM score was associated with an 86% increase in hospital admissions and a 130% increase in inpatient days ($P < .001$ for both comparisons). Similar relationships existed for emergent and urgent outpatient visits and nonurgent outpatient visits. The mean number of emergent and urgent visits approximately doubled (1.5) for patients with a rounded SHFM score of 2, compared with patients with a rounded SHFM score of -1 (0.7; $P < .001$).

Cumulative medical costs at 1 year averaged \$15,330 (SD, \$36,964; median, \$2552; interquartile range, \$718-\$15,055). Higher SHFM scores were significantly associated with higher total costs (Figure 1). On average, inpatient care costs accounted for 84% of total costs, estimated at \$12,808 (SD, \$35,788). Mean inpatient costs ranged from \$5694 among those with an SHFM score of -1 to \$24,535 among those with a score of 2. Mean outpatient care costs, including emergent, urgent, and nonurgent care visits and outpatient procedures, were \$1876 for patients with an SHFM score of -1 and \$3999 for patients with a score of 2. As a linear continuous covariate, SHFM score was a significant predictor of inpatient costs (rate ratio per 1-unit increase, 2.28; $P < .001$), outpatient costs (1.54; $P < .001$), and total costs (2.13; $P < .001$). Predicted 1-year total medical costs generated from the model for SHFM scores of -1, 0, 1 and 2 were \$6,060, \$12,896, \$27,442, and \$58,398, respectively. For baseline SHFM scores of 1 and 2, predicted 1-year mortality was 10.5% and 26.0%. Thus, with an increase in SHFM scores from 1 to 2, 1-year costs were expected to increase by \$1997 for each percentage-point increase in predicted 1-year mortality.

In the sensitivity analysis that excluded patients who died during the first year, 2180 patients (95%) remained. The proportions of patients who had at least 1 hospitalization (38%), at least 1 emergency visit (41%), mean inpatient costs (\$11,970) and total medical costs (\$14,491) over 1 year were consistent with the main analysis (Table 3). Comparisons across the 4 SHFM score groups of counts of medical resource use and medical costs over 1 year after randomization were also consistent. Higher SHFM scores were associated with more hospitalizations, more emergency visits, more outpatient nonurgent visits, and higher inpatient and total costs. Total 1-year medical costs ranged from \$7388 for patients with an SHFM score of -1 to \$28,524 for patients with an SHFM score of 2 ($P < .001$).

Discussion

Seattle Heart Failure Model scores have been widely used in clinical practice to predict survival and to support discussions with patients about the impact of therapeutic interventions and to guide cardiac transplant and ventricular assist device (VAD) placement.^{10,11} We found that SHFM scores are consistently associated with higher rates of inpatient and outpatient medical resource use and associated costs. Patients with predicted 1-year mortality of 26% incurred costs that were almost 4 times higher than costs incurred by patients with predicted 1-year mortality of 1.5%.

A limited number of studies have reported associations between SHFM scores and hospital days. Ketchum et al¹⁰ reported that patients with higher SHFM scores (ie, patients at higher risk) were more likely to have longer hospital stays after VAD placement. Two abstracts reported associations between higher SHFM scores and greater resource use. Bahraïny et al¹² found that higher SHFM scores were associated with longer hospital stays in patients with acute decompensated heart failure. Moorman et al¹³ analyzed data from the Advanced Chronic Heart Failure Clinical Assessment of Immune Modulation Therapy and found linear relationships between SHFM-predicted mortality and annual rates of all-cause and heart failure hospitalizations.

Compared with previous studies that examined relationships between SHFM scores and medical resources, our study has several strengths. The study included a larger sample of patients and examined a wider range of medical resources, including inpatient days, emergency and urgent care visits, and nonurgent outpatient visits. Two of the previous studies had small samples of patients treated at single institutions,^{10,12} in patients who had undergone VAD placement,¹⁰ and both were limited to length of stay associated with an index admission.^{10,12} The only previous study that included patients from multiple sites and examined associations between SHFM scores and longitudinal measures of resource use was limited to abstract form. Thus, methodological detail is sparse, and the study did not evaluate costs. To our knowledge, ours is the first study to report on relationships between SHFM scores and medical costs.

Our study has limitations. First, patients with more severe heart failure were underrepresented. Less than 1% of patients had signs and symptoms consistent with NYHA class IV, but approximately 1 out of 3 (35%) had NYHA class III signs and symptoms at baseline. Future studies with larger samples of patients with NYHA class IV heart failure would be useful in characterizing relationships between SHFM scores and resource use in these patients. Second, we only examined 1-year medical resources and costs after randomization. However, we chose this time horizon to maintain a closer temporal relationship between SHFM scores measured at baseline and subsequent resource use. We recognized that, as some patients experienced disease progression, their SHFM scores would increase, thereby increasing the variance associated with relationships between SHFM scores and resource use or costs. Third, although HF-ACTION collected data on 17 of the 20 variables needed to compute SHFM scores, the trial did not collect patient-level information on allopurinol use, lymphocytes, and serum uric acid. We imputed values for percent lymphocytes and uric acid levels using patient-level characteristics based on externally generated prediction models developed using the original SHFM cohort and we do not expect that this imputation strategy imparted bias, but the assumption of no allopurinol use for all patients would slightly suppress SHFM scores for a small fraction of individuals, expected to range from 4% to 18% as reported in the external data sets used to validate the SHFM.⁴ Fourth, generalized linear models do not provide absolute measures of model fit, like ROC curves for logistic models or R^2 for OLS models. Thus, a convenient means to demonstrate how accurately the models predict resource use and costs is not available.

Given the rising costs of care associated with heart failure, heart failure has become a primary target of disease management programs.^{14–16} Earlier studies of disease management

programs for heart failure reported short-term cost-savings.^{17–21} However, as the literature has grown, so has the variation in economic results, with more studies failing to demonstrate cost savings or reductions in hospital admissions.^{22–25} For programs that may increase costs in the short term, it is useful to evaluate whether the benefits of these programs are commensurate with their costs. However, few studies have examined the long-term costs and benefits of disease management programs.^{26–28} Also, the variable approaches employed for extrapolation make it difficult to disentangle true differences in the cost-effectiveness between programs or differences in methodological strategies or assumptions. To address challenges of extrapolating short-term findings in studies of disease management programs, we are in the final phase of developing a Web-based cost-effectiveness analysis model that will incorporate the relationships between SHFM scores and resource use reported in this paper. This freely available model will provide a common approach to evaluating long-term costs and health outcomes associated with heart failure disease management programs, thereby facilitating direct comparisons between programs. In addition, others could build SHFM scores into forecasting models to predict medical resource use and costs for individuals or groups of patients with heart failure. Such information will be increasingly valuable as providers take on more financial risk with capitated reimbursement and bundled payment schemes.

Although the SHFM was developed to predict survival for heart failure patients, it also predicts medical resource use and costs. These relationships between SHFM scores and medical resource use and costs will be integral to examining the cost-effectiveness of disease management programs or other interventions designed to improve outcomes of patients with heart failure.

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Figure.
Rounded Seattle Heart Failure Model Score and Mean Costs

Table 1

Baseline Characteristics of the Study Population by Seattle Heart Failure Model Score

Characteristic	All Patients (N = 2288)	Rounded Seattle Heart Failure Model Score			P Value ^d
		-1 (n = 264)	0 (n = 1313)	1 (n = 621)	2 (n = 90)
Predicted mortality rate at 1 year, %		1.5	4.0	10.5	26.0
Age, mean (SD)	59 (13)	53 (12)	58 (12)	63 (12)	68 (12)
Sex, No. (%)					
Female	648 (28)	87 (33)	410 (31)	143 (23)	8 (8.9)
Male	1640 (72)	177 (67)	903 (69)	478 (77)	82 (91)
Race, No. (%)					
Black or African American	739 (32)	92 (35)	424 (32)	196 (32)	27 (30)
White	1394 (61)	156 (59)	789 (60)	390 (63)	59 (66)
Other or missing	155 (7)	16 (6.1)	100 (7.6)	35 (5.6)	4 (4.4)
NYHA classification, No. (%)					
II	1457 (64)	249 (94)	978 (74)	219 (35)	11 (12)
III	811 (35)	15 (5.7)	335 (26)	394 (63)	67 (74)
IV	20 (0.9)	—	—	8 (1.3)	12 (13)
Ischemic etiology, No. (%)	1176 (51)	66 (25)	634 (48)	406 (65)	70 (78)
Ejection fraction, mean (SD), %	25.2 (7.5)	26.7 (6.7)	25.8 (7.6)	23.5 (7.1)	23.4 (7.5)
Systolic blood pressure, mean (SD), mm Hg	114 (18)	129 (19)	115 (17)	107 (16)	104 (17)
Diastolic blood pressure, mean (SD), mm Hg	70 (11)	79 (12)	71 (11)	67 (10)	64 (9)
Laboratory tests					
Total cholesterol, mean (SD), mg/dL	168 (45)	185 (42)	172 (44)	155 (43)	135 (43)
Hemoglobin, mean (SD), g/dL	13 (1.6)	14 (1.3)	14 (1.5)	13 (1.7)	12 (1.7)
Medications					
β-Blocker, No. (%)	2163 (95)	264 (100)	1269 (97)	550 (89)	80 (89)
Loop diuretic, No. (%)	1776 (78)	160 (61)	971 (74)	560 (90)	85 (94)
Diuretic dose, mean (SD), mg/kg/d	0.7 (0.7)	0.3 (0.4)	0.5 (0.5)	1.0 (0.8)	1.8 (1.6)
ACE inhibitor, No. (%)	1701 (74)	222 (84)	996 (76)	438 (71)	45 (50)

Characteristic	All Patients (N = 2288)	Rounded Seattle Heart Failure Model Score				P Value ^a
		-1 (n = 264)	0 (n = 1313)	1 (n = 621)	2 (n = 90)	
Lipid-lowering agent, No. (%)	1074 (47)	165 (63)	664 (51)	213 (34)	32 (36)	<.001
Spirolactone/eprenone, No. (%)	1030 (45)	167 (63)	594 (45)	238 (38)	31 (34)	<.001
Angiotensin receptor blockers, No. (%)	537 (24)	61 (23)	308 (24)	144 (23)	24 (27)	.77
Implantable cardioverter-defibrillator	917 (40)	129 (49)	499 (38)	251 (40)	38 (42)	.15
Medical history, No. (%)						
Hypertension	1362 (60)	172 (65)	770 (59)	358 (58)	62 (69)	.42
Myocardial infarction	962 (42)	57 (22)	519 (40)	334 (54)	52 (58)	<.001
Diabetes mellitus	731 (32)	65 (25)	403 (31)	221 (36)	42 (47)	<.001
Angina	577 (25)	40 (15)	338 (26)	170 (27)	29 (32)	<.001
Chronic obstructive pulmonary disease	243 (11)	11 (4.2)	127 (9.7)	89 (15)	16 (18)	<.001
Stroke	235 (10)	28 (11)	114 (8.7)	77 (12)	16 (18)	.001
Peripheral vascular disease	151 (6.6)	9 (3.4)	77 (5.9)	55 (8.9)	10 (11)	<.001

^a P value from analysis of variance for categorical variables and Pearson correlation coefficient for continuous variables.

Table 2

Medical Resource Use and Costs at 1 Year by Seattle Heart Failure Model Score

Variable	All Patients (N = 2288)	Rounded Seattle Heart Failure Model Score			P Value
		-1 (n = 264)	0 (n = 1313)	1 (n = 621)	2 (n = 90)
Medical resources					
Proportion of patients with ED or urgent care visits, No. (%)	960 (42)	96 (36)	530 (40)	280 (45)	54 (60)
Proportion of patients hospitalized, No. (%)	911 (40)	66 (25)	463 (35)	329 (53)	53 (59)
Non-urgent outpatient visits					
Mean (SD)	12.3 (13.2)	9.6 (12.2)	11.8 (13.2)	14.2 (13.0)	15.4 (14.3)
Median (interquartile range)	9.0 (4.0–16.0)	6.0 (3.0–11.0)	8.0 (4.0–15.0)	11.0 (6.0–20.0)	12.0 (6.0–18.0)
ED or urgent outpatient visits					
Mean (SD)	0.8 (1.6)	0.7 (1.4)	0.8 (1.4)	1.0 (2.0)	1.5 (2.4)
Median (interquartile range)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	1.0 (0.0–2.0)
Hospital admission					
Mean (SD)	0.8 (1.3)	0.4 (1.0)	0.6 (1.1)	1.1 (1.5)	1.5 (1.8)
Median (interquartile range)	0.0 (0.0–1.0)	0.0 (0.0–0.5)	0.0 (0.0–1.0)	1.0 (0.0–2.0)	1.0 (0.0–3.0)
Inpatient days					
Mean (SD)	4.8 (12.2)	2.1 (6.0)	3.6 (11.2)	7.4 (14.7)	11.4 (15.8)
Median (interquartile range)	0.0 (0.0–5.0)	0.0 (0.0–1.0)	0.0 (0.0–3.0)	2.0 (0.0–8.0)	3.0 (0.0–18.0)
Medical costs					
Inpatient care costs, \$					
Mean (SD)	12,808 (35,788)	5694 (16,573)	9912 (30,493)	20,256 (47,532)	24,535 (43,068)
Median (interquartile range)	0 (0–10,356)	0 (0–622)	0 (0–6527)	3330 (0–20,732)	6341 (0–34,667)
Outpatient care costs, \$					
Mean (SD)	2522 (4267)	1876 (2995)	2314 (3855)	3023 (4801)	3999 (7473)
Median (interquartile range)	1361 (575–2854)	1007 (415–2277)	1267 (525–2739)	1772 (754–3148)	1891 (1013–3564)
Total medical costs, \$					
Mean (SD)	15,330 (36,964)	7570 (17,663)	12,226 (31,356)	23,278 (48,923)	28,535 (45,638)
Median (interquartile range)	2552 (718–15,055)	1220 (447–5272)	2088 (646–9882)	6617 (1197–24,473)	10,609 (2055–41,524)

Abbreviation: ED, emergency department.

Table 3

Medical Resource Use and Costs at 1 Year by Seattle Heart Failure Model Score After Exclusion of Patients Who Died Within 1 Year

Variable	All Patients (N = 2180)	Rounded Seattle Heart Failure Model Score			P Value
		-1 (n = 261)	1 (n = 567)	2 (n = 75)	
Medical resources					
Proportion of patients with ED or urgent care visits, No. (%)	889 (41)	94 (36)	245 (43)	45 (60)	< .001
Proportion of patients hospitalized, No. (%)	832 (38)	64 (25)	288 (51)	41 (59)	< .001
Non-urgent outpatient visits					< .001
Mean (SD)	12.4 (13.2)	9.5 (12.2)	14.6 (13.2)	15.7 (13.6)	
Median (interquartile range)	9.0 (5.0–16.0)	6.0 (3.0–11.0)	11.0 (6.0–20.0)	13.0 (7.0–18.0)	
ED or urgent outpatient visits					< .001
Mean (SD)	0.8 (1.6)	0.7 (1.4)	1.0 (2.0)	1.4 (2.2)	
Median (interquartile range)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	1.0 (0.0–2.0)	
Hospital admission					< .001
Mean (SD)	0.7 (1.2)	0.4 (1.0)	1.0 (1.5)	1.5 (1.9)	
Median (interquartile range)	0.0 (0.0–1.0)	0.0 (0.0–0.0)	1.0 (0.0–1.0)	1.0 (0.0–3.0)	
Inpatient days					< .001
Mean (SD)	4.3 (11.6)	2.0 (5.9)	6.4 (13.1)	10.9 (16.1)	
Median (interquartile range)	0.0 (0.0–4.0)	0.0 (0.0–0.0)	2.0 (0.0–7.0)	3.0 (0.0–16.0)	
Medical costs					
Inpatient care costs, \$					< .001
Mean (SD)	11,970 (34,855)	5516 (16,480)	18,560 (46,384)	24,371 (45,586)	
Median (interquartile range)	0 (0–8381)	0 (0–0)	2442 (0–18,138)	3965 (0–34,667)	
Outpatient care costs, \$					< .001
Mean (SD)	2522 (4311)	1873 (3,011)	3095 (4,961)	4153 (7917)	
Median (interquartile range)	1347 (573–2850)	993 (415–2266)	1788 (748–3155)	1938 (1013–3726)	
Total medical costs, \$					< .001
Mean (SD)	14,491 (36,052)	7388 (17,589)	21,655 (47,920)	28,524 (48,310)	
Median (interquartile range)	2414 (689–13,045)	1167 (445–4886)	5494 (1103–22,084)	9196 (1817–41,524)	

Abbreviation: ED, emergency department.