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Socioeconomic status, treatment, and outcomes among elderly patients hospitalized with heart failure: Findings from the National Heart Failure Project

Saif S. Rathore, MPH[a], **Frederick A. Masoudi, MD, MSPH, FACC**[c,d,e,f], **Yongfei Wang, MS**[a], **Jeptha P. Curtis, MD**[a], **JoAnne M. Foody, MD**[a], **Edward P. Havranek, MD, FACC**[d,e,f], and **Harlan M. Krumholz, MD, SM, FACC**[a,b,g]

[a] Section of Cardiovascular Medicine, Department of Internal Medicine, Yale University School of Medicine, New Haven, CT

[b] Section of Health Policy and Administration, Department of Epidemiology and Public Health, Yale University School of Medicine, New Haven, CT

[c] Division of Geriatric Medicine, Denver Health Medical Center, Denver, CO

[d] Division of Cardiology, Department of Medicine, Denver Health Medical Center, Denver, CO

[e] Colorado Foundation for Medical Care, Aurora, CO

[f] Division of Cardiology, Department of Medicine, University of Colorado Health Sciences Center, Denver, CO

[g] Yale-New Haven Hospital Center for Outcomes Research and Evaluation, New Haven, CT

Abstract

Background—Prior studies have reported conflicting findings concerning the association of socioeconomic status (SES), treatment, and outcomes in patients hospitalized with heart failure (HF).

Methods—We conducted a retrospective analysis of medical record data from a national sample of Medicare beneficiaries hospitalized with HF between March 1998 and April 1999 (n = 25086) to assess the association of patient SES, treatment, and outcomes. Patients' SES was designated as lower, lower-middle, higher-middle, and higher using residential ZIP code characteristics. Patients were evaluated for left ventricular systolic function assessment, prescription of angiotensin-converting enzyme inhibitors at discharge, readmission within 1 year of discharge, and mortality within 30 days and 1 year of admission. Hierarchical logistic regression models were used to assess the association of SES, quality of care, and outcomes adjusting for patient, physician, and hospital characteristics.

Correspondence: Saif S. Rathore, Yale University School of Medicine, Room IE-61 SHM, 333 Cedar Street, PO Box 208088, New Haven, CT 06520-8088. saif.rathore@yale.edu.

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Results—Lower SES patients (relative risk [RR] 0.92, 95% CI 0.87–0.96) were modestly less likely to have had a left ventricular systolic function assessment, but had a similar adjusted likelihood of being prescribed angiotensin-converting enzyme inhibitors (RR 1.03, 95% CI 0.93–1.11) compared with higher SES patients after multivariable adjustment. Socioeconomic status was not associated with 30-day mortality after multivariable adjustment, but lower SES patients had a higher risk of 1-year mortality (RR 1.10, 95% CI 1.02–1.19) and readmission within 1 year of discharge (RR 1.08, 95% CI 1.03–1.12) compared with higher SES patients.

Conclusions—Socioeconomic status in patients hospitalized with HF was not strongly associated with quality of care or 30-day mortality. However, the increased risk of 1-year mortality and readmission among patients of lower SES suggest SES may influence outcomes after hospitalization for HF.

Socioeconomic variations in heart failure (HF) treatment and outcomes raise obvious concerns about equity in health and health care. Further, variations in the quality of HF treatment may be particularly detrimental given the increasing prevalence and poor prognosis of patients with HF.[1] However, few studies have assessed the impact of patient SES on HF care.[2] Patients with lower income and less education were less likely to see a cardiologist or obtain a cardiology consultation when treated by a generalist during hospitalization[3] and reportedly received poorer quality of care and were less clinically "stable" at discharge,[4] although another study suggested no independent association between income and quality of care.[5] These studies' limitations, including selected patient populations,[3,5] limited definitions of SES,[4] and the assessment of patients treated in the 1980s and early 1990s,[4,5] preclude any clear assessment of the contemporary association between SES and HF care. This uncertainty is problematic because understanding how socioeconomic factors may influence treatment may help inform current efforts directed at remedying social disparities in care.[6]

Socioeconomic variations in quality of care are paralleled by reports of disparities in patient outcomes. Previous studies have identified higher rates of hospitalization and readmission for patients with HF who are unemployed,[7] have lower incomes,[8] or reside in deprived areas,[9,10] whereas others have suggested that socioeconomic attributes are not independently associated with hospital use.[11–14] Similarly, data concerning the relationship between SES and outcomes among patients with HF are also inconsistent.[4,14–19] Because these studies have relied upon small numbers of patients treated at specific centers or other selected populations,[8,10,12–14,17–19] including patients treated outside of the United States,[7,9,14,15,17] lacked clinically detailed data,[13,16] or reflected practice patterns that are more than a decade old,[4,11] the influence of SES on patient outcomes after hospitalization for HF is unclear. Clarifying the association between patient SES and outcomes may help in identifying potential targets for efforts to achieve reductions in health disparities mandated by current federal initiatives.[6]

To assess the association of SES, HF treatment, and outcomes, we evaluated a national cohort of Medicare patients hospitalized with HF in the United States. Our evaluation of a contemporary, unselected cohort of patients with a common source of health insurance provides a unique opportunity to determine whether SES is associated with the quality of care, readmission rates, and mortality in a cohort of elderly patients.

Methods

National Heart Care Project

The Centers for Medicare & Medicaid Services National Heart Care Project is an ongoing quality of care initiative for Medicare beneficiaries hospitalized with cardiovascular diseases, including HF. As part of the project, a cohort of fee-for-service Medicare beneficiaries hospitalized with a principal discharge diagnosis of HF (International Classification of

Diseases, Ninth Revision, Clinical Modification code 402.01, 402.11, 402.91, 404.01, 404.91, or 428)[20] between March 1998 and April 1999 were identified to assess the quality of their medical care. Hospitalizations of patients with valid social security numbers who were not receiving long-term hemodialysis, were not transferred to another acute care hospital, and did not leave against medical advice were considered eligible.[21] All hospitalizations meeting these initial criteria were sorted by age, sex, race, and hospital based on the state in which they were treated. Eight hundred hospitalizations were randomly sampled from each state, and states with fewer than 800 eligible hospitalizations (Alaska, Hawaii, Idaho, Utah, Vermont, Wyoming) were sampled in their entirety. Medical records of selected hospitalizations were collected in 2 central data abstraction centers and reviewed by trained abstractors for detailed clinical data.

Study cohort

Of the 39477 initially sampled hospitalizations, 2054 were excluded after chart abstraction identified one of the project's exclusion criteria (chronic hemodialysis, discharge against medical advice, an invalid social security number, a repeat admission), leaving a cohort of 37423 patients. Patients younger than 65 years of age (n = 2909) were excluded because these Medicare beneficiaries are not representative of the general population under the age of 65. Patients who arrived by interhospital transfer (n = 1046) and those without chart documentation of HF on admission (n = 2324) were also excluded to ensure a cohort of patients presenting with HF. Patients hospitalized outside of the 50 states and the District of Columbia (n = 627) were also excluded. In total, 6455 patients met one or more of the above exclusions, resulting in a cohort of 30968 patients.

Socioeconomic status

Patient SES was determined using a surrogate based on the sociodemographic characteristics of the patient's ZIP code of residence. Residence-based socioeconomic information is a validated proxy for patient SES in the absence of individual-level data.[22] Although area-based measures aggregate individual socioeconomic and ecological effects, patients residing in areas identified at the extremes generally represent socially homogenous groups.[23]

ZIP codes are defined by the US Postal Service for mail delivery and thus may not accurately correspond to geographically defined areas (ie, blocks, tracts) defined by the US Census.[24] To address this issue, we used REZIDE, a proprietary database produced by Claritas Corporation (San Diego, CA), which provides ZIP code–level residential demographic characteristics based on geo-coded Census block data.[25] We used Claritas' ZIP Quality (ZQ) rating, a composite measure derived from each ZIP code's median household income, educational attainment of persons 25 years and older, occupation of employed persons, and home value. ZIP Quality scores range from 0 to 100, with a national mean of 50 and scaled standard deviations of 10 points, and have been used to identify areas with differing socioeconomic characteristics.[25]

Patients were assigned to 1 of 4 groups based on their ZQ score—lower SES (<40, more than 1 SD below national mean), lower-middle SES (40–49, below the national mean but within 1 SD), higher-middle SES (50–59, above the national mean but within 1 SD), and higher SES (60 and higher, more than 1 SD above the national mean).[25] To ensure that reported ZIP codes reflected noninstitutional locations, we restricted our analysis to those patients admitted from home or an outpatient setting (n = 4865 exclusions). An additional 1017 patients with missing residential ZIP code data and those residing in ZIP codes for which ZQ scores were not available were excluded, leaving 25086 patients available for analysis.

Quality of care

We evaluated 2 Centers for Medicare & Medicaid Services quality of HF care process indicators—documentation of left ventricular systolic function (LVSF) and prescription of

ACE inhibitors to ideal candidates (Table I).[26] Documentation of LVSF was defined as a medical record notation of prior LVSF evaluation with a reported LVSF, in-hospital assessment of LVSF, or a notation of a planned postdischarge LVSF assessment among patients who survived to discharge. The prescription of ACE inhibitors at discharge was assessed in patients with left ventricular systolic dysfunction (defined as either a qualitative assessment of moderate or severe left ventricular systolic dysfunction or a quantitative left ventricular ejection fraction <0.40) who had no documented contraindications to ACE inhibitor therapy. We also examined the composite end point of prescription of ACE inhibitor or angiotensin receptor blockers (ARBs) to account for possible therapeutic substitution.

Patient outcomes

Patient mortality at 30 days and 1 year after admission was determined using the Medicare Enrollment Database. All-cause readmissions within 1 year of discharge were determined from Medicare claims data.

Statistical analysis

We compared patient, attending physician, and treating hospital characteristics, and eligibility for each of the quality indicators across the 4 SES groups using global χ^2 tests, tests of trend, and analyses of variance.

Rates of LVSF documentation, ACE inhibitor prescription, readmission at 1-year, 30-day mortality, and 1-year mortality were compared across the 4 SES groups using global χ^2 analyses and tests of trend. Because of the correlation between race and SES, crude analyses were repeated stratifying by race with interactions tested for using Mantel-Hanzel tests of heterogeneity.

Separate 2-level hierarchical mixed effects models were used to assess each quality of care and outcome measure while accounting for the clustering of patients within hospitals. Each multilevel model incorporated factors associated with quality of care and outcomes to assess the independent association of SES, quality of care, and outcomes. Variables incorporated in each model included patient age, race, LVSF (<0.40, ≥0.40, unknown), medical history (coronary artery disease, chronic obstructive pulmonary disease, dementia, nursing home admission), and a modified version of the Medicare Mortality Prediction System score.[27] Analyses also adjusted for the self-reported specialty and board certification of the attending physician, identified by the unique physician identification number listed on the hospitalization's UB-92 claim, as reported in the American Medical Association Physician Masterfile. Hospital characteristics, including number of beds, rural location, ownership, teaching status, level of cardiac care facilities, and US Census region were obtained from the 1998 American Hospital Association Annual Survey of Hospitals.

The model intercept and SES variables were initially entered as random effects in all analyses; all other variables were modeled as fixed effects. Dummy variables were used to denote patients with missing physician or hospital characteristic information. Odds ratios were converted to estimated risk ratios.[28] All analyses used probability weights based on each state's inverse sampling fraction. Statistical analyses were conducted using Stata 8.0 (Stata Corporation, College Station, Tex) and MLwiN (Institute of Education, London, United Kingdom). Analysis of the National Heart Care database was approved by the Yale University School of Medicine Human Investigation Committee.

Results

Of the 25086 patients, 13.6% were classified as lower SES, 53.6% as lower-middle SES, 22.3% as higher-middle SES, and 10.6% as higher SES. Lower SES patients were younger on average, and greater proportions were female and nonwhite than upper class patients. Lower SES patients had a lower prevalence of coronary disease, prior myocardial infarction, prior coronary revascularization, and aortic stenosis, but a higher prevalence of diabetes, chronic obstructive pulmonary disease, and hypertension than patients of higher SES. A greater proportion of lower SES patients were treated in hospitals that were publicly owned, nonteaching, without invasive cardiac care facilities, and located in the South and rural areas compared with patients of higher SES. Similarly, the proportion of patients treated by cardiologists and board-certified physicians was also lowest among lower SES patients (Table II).

Overall, 96% of patients were classified as eligible for assessment of LVSF and 15% were classified as ideal candidates for ACE inhibitor prescription. The proportions of patients classified as eligible for the 2 indicators were comparable across the 4 SES groups.

Crude rates of LVSF assessment rates were lowest among lower SES patients and successively increased with higher SES (62.5%, 67.0%, 71.8%, 75.1%, P <.001) (Table III). However, lower crude rates of LVSF assessment in lower SES patients were restricted to white patients (58.8%, 66.4%, 72.3%, 75.0%, P <.001) and not observed among black patients (68.5%, 70.8%, 66.6%, 67.2%, P = .67; P <.001 for interaction). In contrast, crude rates of ACE inhibitor prescription (lower 75.0%, lower-middle 74.4%, higher-middle 78.8%, higher 73.3%, P = .26) and ACE inhibitor or ARB prescription (lower 82.5%, lower-middle 81.9%, higher-middle 86.1%, higher 83.4%, P = .27) were comparable across the 4 socioeconomic groups. Patient race did not modify the association between SES and prescription of ACE inhibitors or ACE inhibitors or ARBs.

Lower (relative risk [RR] 0.92, 95% CI 0.87–0.96) and lower-middle (RR 0.95, 95% CI 0.92–0.98) SES patients remained less likely to undergo LVSF assessment than higher SES patients after multivariable adjustment. Among patients classified as ideal candidates for ACE inhibitors, lower and lower-middle SES patients had similar adjusted likelihoods of being prescribed ACE inhibitors (lower RR 1.03, 95% CI 0.93–1.11; lower-middle RR 1.02, 95% CI 0.94–1.08) and ACE inhibitor or ARBs (lower RR 0.99, 95% CI 0.90–1.06; lower-middle RR 0.98, 95% CI 0.90–1.03) as higher SES patients (Table III).

Crude 1-year readmission rates were highest among lower SES patients and decreased across successively higher SES groups (71.8%, 67.7%, 67.4%, 65.8%, P <.001), a pattern that was similar across racial groups (interaction P = .55, results not shown). Lower SES patients remained at an increased risk of readmission (RR 1.08, 95% 1.03–1.12) compared with higher SES patients after multivariable adjustment. There was no increased risk of readmission among lower-middle (RR 1.01, 95% CI 0.98–1.05) and higher-middle SES (RR 1.02, 0.98–1.05) patients (Table IV).

Crude mortality rates were comparable among lower, lower-middle, higher-middle, and higher SES patients at 30 days (8.1%, 8.3%, 8.5%, 8.7%, respectively, P = .92) and 1 year (33.5%, 36.1%, 35.7%, 36.1%, respectively, P = .23) after admission. Race did not modify the association between SES and 30-day (P = .38 for interaction) or 1-year mortality (P = .41, results not shown).

Patient SES was not associated with mortality at 30 days on adjusted analysis (lower RR 1.13, 95% CI 0.92–1.38; lower-middle RR 1.03, 95% CI 0.87–1.22; higher-middle RR 1.01, 95% CI 0.85–1.20; higher, RR 1.00, referent). However, lower (RR 1.10, 95% CI 1.02–1.19) and

lower-middle (RR 1.12, 95% CI 1.05–1.18) SES patients had an increased risk of 1-year mortality compared with higher SES patients (Table IV).

Discussion

Lower class elderly patients hospitalized with HF had a higher risk of readmission and 1-year mortality than upper class patients. Similarly, patients with fewer socioeconomic resources had lower rates of LVSF assessment, but similar rates of ACE inhibitor and ACE inhibitor or ARB prescription than upper class patients. These findings suggest that patient SES is associated with selected variations in quality of care and has a more consistent association with longer-term outcomes among elderly Medicare beneficiaries hospitalized for HF.

Modestly higher rates of hospital readmission in patients with lower SES documented in our analysis and the consistency of this finding with other US[29] and international studies[7,9] suggest that patients with fewer socioeconomic resources experience a less stable course after hospital discharge. Other studies have shown that patients with limited socioeconomic resources are less likely to have a regular medical provider[30] and have fewer ambulatory care visits than patients of higher SES,[31] thus decreasing their likelihood of receiving ongoing care. Lack of or poorer access to ambulatory care may also cause patients with HF of lower SES to defer seeking care until their condition has deteriorated such that hospitalization is necessary. Relatively less education, diminished health literacy, and other social factors may also affect these patients' abilities to adhere to treatment recommendations. Because readmissions for patients with HF are often precipitated by other conditions,[32] factors other than HF treatment may also contribute to the higher risk of readmission in patients of lower SES. Some physicians, faced with patients who are unable to effectively manage a HF exacerbation in the outpatient setting, may elect to admit such patients to provide effective care.[14] Alternatively, patients of lower SES may have less access to adequate outpatient care services and may themselves seek readmission to ensure access to effective care.[2] Without clinical data concerning patients' status at readmission, it is unclear whether such hospitalizations were medically "necessary".

The increased risk of mortality observed in this study is consistent with the broader pattern of poorer health observed in lower socioeconomic groups in the general community.[33] The specific mechanisms underlying this risk are unknown. Our analysis adjusted for HF etiology, measures of HF severity, and other comorbid characteristics, suggesting mortality differences are likely not due to confounding by other clinical characteristics. Previous studies, however, have suggested that patients of lower SES are exposed to a variety of processes associated with increased mortality. Such mediators include lower rates of social support and social participation, higher rates of depression and neuropsychiatric stress, and other psychosocial factors which may limit these patients' ability to cope with illness.[34] Increased mortality among patients of lower SES after hospitalization may also reflect behavioral patterns and preexisting deprivation due to occupation, education, residence, and other factors.[33,35] Regardless of the mechanisms resulting in this increased risk, our findings support the general hypothesis that low SES should be considered a risk factor for adverse outcomes among patients with HF.

The relative effects of lower SES on LVSF assessment, readmission, and 1-year mortality compared to higher SES did not exceed 15%. These effect sizes are subject to concerns of residual confounding. Assuming our findings do represent a true SES-associated effect, these differences are likely clinically meaningful. A 10% to 15% relative difference in treatment and outcomes between lower class and upper class patients would have a substantial public health impact given the generally poor prognosis of the more than 1 million patients hospitalized for HF in the United States annually.[1] For instance, assuming that our estimate of the socioeconomic distribution of patients with HF is generalizable to the full 1 million hospitalized for HF in the United States each year, more than two thirds (672000 patients) would be of

lower or lower-middle SES. Extrapolating the average excess 1-year mortality risk of 10% for lower and lower-middle SES patients observed in our study to the overall 1-year mortality rate of 35.6% suggests nearly 24000 additional deaths in this population.

Socioeconomic variations in the quality of care provided to elderly patients hospitalized with HF were only observed among white patients for LVSF assessment. The lack of a consistent association between SES and treatment raises concerns that this may represent a chance finding. Alternatively, if this does represent a "true" effect, it would suggest that the association between SES and quality of care may not be consistent across treatments or population. The factors that may account for this specific variation are unknown. Financial factors were unlikely to have played a role in the provision of inpatient care in this insured fee-for-service population given that the costs of LVSF assessment would be subsumed in Medicare's fixed diagnostic related grouping–based reimbursements. The fact that differences in treatment were only observed for a diagnostic test and not for use of a drug therapy, similar to patterns observed in patients with myocardial infarction,[36] suggests that some characteristic particular to procedure use may introduce or exacerbate disparities in care. It is unclear whether such variations reflect physician or patient decision making, and we know of no studies that support (or refute) socioeconomic variations in patient preferences for LVSF assessment. Given that lower rates of LVSF documentation represent poorer quality of care, future work is needed to clarify the processes underlying this difference in care.

Although based on a nationally representative, community-based, contemporary cohort of elderly patients hospitalized with HF, our study has certain issues that merit consideration. First, our use of ZIP code–based measures of SES raises concerns of the ecological fallacy or the inappropriate attribution of area-based characteristics to individual patients. To minimize this potential bias, we compared treatment and outcomes between patients residing in the more homogeneous socioeconomic extremes of lower class and upper class areas. Further, we do not have data concerning patients' socioeconomic history and thus cannot account for the effect of different historical exposures on patient outcomes. Second, our analysis evaluated fee-for-service Medicare patients aged 65 years and older hospitalized with HF. Thus, our estimates of the effect of SES may not be applicable to patients younger than 65 years of age, patients enrolled in Medicare managed care plans, those not enrolled in Medicare, or reflect treatment patterns in the ambulatory setting. Because patients older than 65 years represent more than 80% of patients with HF in the United States and acute exacerbations of HF requiring hospitalization in this population are common,[1] we believe our findings are likely generalizable to most patients with HF in the United States. Third, because our definition of care quality relied upon 2 guideline-based measures, we cannot preclude the possibility that SES may have influenced patient treatment in a manner other than we assessed. Finally, our evaluation of outcomes was limited to readmission and mortality, and we were unable to assess any association between SES and other patient outcomes.

Lower patient SES was associated with lower rates of LVSF assessment and modestly increased risks of readmission and mortality at 1-year among elderly patients hospitalized with HF. Although it is unclear what processes account for our findings, our study is consistent with reports that have identified higher rates of adverse outcomes among patients of lower socioeconomic position. Our findings suggest that SES merits consideration as an independent risk factor for adverse outcomes among patients with HF. Understanding the mechanisms accounting for this increased risk may help attenuate poorer outcomes among patients of lower SES.

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Table I

Quality indicator eligibility criteria

Prescription of ACE inhibitors*
Eligibility
Patient alive at time of discharge
Evidence of left ventricular systolic dysfunction during hospitalization (LVEF <40%)
No moderate or severe aortic stenoses
No moderate or severe bilateral renal
No physician documentation of any reason for withholding ACE inhibitor therapy
Patient not enrolled in clinical trials of an alternative to ACE inhibitor therapy
Serum creatinine =2.0 mg/dL
Serum potassium during hospitalization =5.5 mg/dL
Quality of care measure
ACE inhibitor prescribed on discharge
Current LVEF measurement
Eligibility
Patient alive at time of discharge
Quality of care measure
LVEF assessed before hospitalization and noted in medical record or
Patient received LVEF assessment during hospitalization or
Patient scheduled to receive LVEF evaluation after discharge

ACE, angiotensin-converting enzyme.

* Same criteria used to evaluate prescription of ACE inhibitors or ARBs.

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Table II

Patient characteristics, hospital characteristics, and physician characteristics

Characteristics	Socioeconomic status					
	Overall	Lower	Lower-middle	Higher-middle	Higher	*P*
% of cohort	100.0	13.6	53.6	22.3	10.6	–
Mean age, y (SD)	78.8 (0.1)	78.0 (0.2)	78.5 (0.1)	79.2 (0.2)	80.4 (0.2)	<.001
Female	57.7	60.9	58.2	55.4	56.0	.002
Race						<.001
White	84.5	64.8	85.3	90.4	93.6	
Black	11.7	28.2	11.6	6.2	2.6	
Other	3.8	7.1	3.1	3.5	3.8	
Admission characteristics						
Mean systolic blood pressure, mm Hg (SD)	147.0 (0.3)	148.7 (0.7)	146.9 (0.4)	147.2 (0.6)	144.5 (0.9)	.003
Mean heart rate, beats/min (SD)	90.8 (0.2)	90.5 (0.5)	91.0 (0.3)	91.0 (0.4)	89.5 (0.6)	.15
Peripheral edema	73.1	74.7	73.4	72.3	70.8	.059
Medical history						
Congestive heart failure	72.0	72.6	71.6	72.6	71.5	.63
ACE inhibitor or ARB before admission	49.5	50.6	49.3	49.7	48.7	.73
Prior myocardial infarction	29.7	24.7	29.7	32.7	29.7	<.001
Prior coronary disease	58.3	52.7	58.0	61.9	59.6	<.001
Angina	18.4	16.6	18.4	19.4	19.0	.11
Hypertension	63.0	65.9	62.2	64.0	60.8	.008
Diabetes	39.5	43.8	40.3	38.3	32.7	<.001
Prior CABG	23.7	18.5	23.1	26.1	27.9	<.001
Prior PTCA	9.2	5.9	9.0	11.4	10.2	<.001
Chronic pulmonary disease	33.3	34.8	34.4	32.8	26.7	<.001
Dementia/Alzheimer's disease	5.9	5.3	5.7	5.8	7.6	.033
Aortic stenosis	7.3	5.1	7.0	8.3	9.2	<.001
Mobility						<.001
Independent self-ambulation	36.2	34.6	35.2	37.8	40.2	
Dependent	36.7	34.1	36.6	37.4	39.1	
Unknown	27.1	31.3	28.2	24.8	20.6	
Urinary incontinence						.002
Continent	58.2	56.5	57.0	60.1	62.5	
Incontinent	11.4	10.8	11.5	11.5	11.3	
Unknown	30.4	32.7	31.5	28.4	26.3	
Admission serum potassium =5.5 mg/dL	94.4	93.9	94.6	94.1	95.0	.43
Admission serum creatinine =2.0 mg/dL	83.5	82.0	84.0	83.2	83.7	.24
Hospital characteristics						
Hospital data not available	3.6	3.4	2.8	4.9	5.3	.005
Mean number of beds (SD)	297 (6)	283 (11)	277 (6)	335 (9)	343 (11)	<.001
Located in an urban area	75.4	59.2	68.0	93.4	97.1	<.001
Ownership						<.001
Public	13.0	19.3	15.1	7.6	4.8	
Not-for-profit	71.6	62.6	70.0	76.7	80.1	
For-profit	12.0	14.6	10.8	10.8	9.8	
Teaching status						<.001
COTH member	12.6	13.7	9.8	15.7	18.8	
Residency-affiliated	20.8	18.4	19.8	23.8	22.4	
Nonteaching	63.0	64.5	67.6	55.7	53.5	
Cardiac care facilities						<.001
Cardiac surgery capable	35.0	33.5	32.6	40.1	38.7	
Cardiac catheterization laboratory	20.2	15.5	20.6	20.1	24.2	
No invasive facilities	41.2	47.6	44.0	34.9	31.8	
US Census region						<.001

Characteristics	Socioeconomic status					
	Overall	Lower	Lower-middle	Higher-middle	Higher	*P*
Northeast	21.0	10.5	17.8	28.3	35.0	
Midwest	26.2	24.1	29.8	23.2	17.0	
South	38.9	58.5	41.5	28.0	24.0	
West	13.9	7.0	10.9	20.6	24.1	
Physician characteristics						
Physician data not available	11.4	15.1	10.7	11.4	10.3	<.001
Board certification	69.3	61.6	69.3	71.1	75.5	<.001
Physician specialty						<.001
Cardiologist	23.4	16.6	21.6	28.4	31.0	
Internist	41.9	39.5	41.4	42.4	46.1	
Family/general practitioners	20.1	25.6	23.0	14.6	9.9	
Others	14.6	18.3	14.0	14.6	13.0	
Foreign medical graduate	28.6	28.9	28.7	28.5	28.9	.96
Mean years in practice (SD)	21.2 (0.1)	20.7 (0.3)	20.9 (0.1)	21.8 (0.2)	22.0 (0.3)	<.001

CABG, coronary artery bypass graft; *PTCA*, percutaneous transluminal coronary angioplasty; *COTH*, Council of Teaching Hospitals.

Table III

Socioeconomic status and quality of care

		Socioeconomic status					
	Overall	**Lower**	**Lower-middle**	**Higher-middle**	**Higher**	***P***	**Higher vs lower *P***
Prescription of ACE inhibitors							
Crude rate	75.4	75.0	74.4	78.8	73.3	.26	.67
Crude risk ratio (95% CI)	–	1.03 (0.94–1.11)	1.02 (0.95–1.08)	1.08 (1.01–1.14)	1.00 (referent)	.063	.50
Adjusted risk ratio (95% CI)	–	1.03 (0.93–1.11)	1.02 (0.94–1.08)	1.10 (1.03–1.16)	1.00 (referent)	.009	.58
Prescription of ACE inhibitors or ARBs							
Crude rate	83.1	82.5	81.9	86.1	83.4	.27	.80
Crude risk ratio (95% CI)	–	0.99 (0.91–1.06)	0.98 (0.91–1.04)	1.04 (0.97–1.08)	1.00 (referent)	.094	.88
Adjusted risk ratio (95% CI)	–	0.99 (0.90–1.06)	0.98 (0.90–1.03)	1.04 (0.98–1.09)	1.00 (referent)	.041	.78
Current LVEF measurement							
Crude rate	68.3	62.5	67.0	71.8	75.1	<.001	<.001
Crude risk ratio (95% CI)	–	0.83 (0.78–0.87)	0.87 (0.83–0.91)	0.92 (0.88–0.96)	1.00 (referent)	<.001	<.001
Adjusted risk ratio (95% CI)	–	0.92 (0.87–0.96)	0.95 (0.92–0.98)	0.97 (0.94–1.00)	1.00 (referent)	<.001	<.001

Table IV

Socioeconomic status, readmission, and mortality

		Socioeconomic status					
	Overall	**Lower**	**Lower-middle**	**Higher-middle**	**Higher**	***P***	**Higher vs lower *P***
Readmission within 1 year of discharge							
Crude rate	68.0	71.8	67.7	67.4	65.8	.003	<.001
Crude risk ratio (95% CI)	–	1.11 (1.07–1.15)	1.04 (1.00–1.07)	1.03 (0.99–1.06)	1.00 (referent)	<.001	<.001
Adjusted risk ratio (95% CI)	–	1.08 (1.03–1.12)	1.01 (0.98–1.05)	1.02 (0.98–1.05)	1.00 (referent)	<.001	<.001
Thirty-day mortality							
Crude rate	8.4	8.1	8.3	8.6	8.7	.92	.59
Crude risk ratio (95% CI)	–	0.90 (0.75–1.08)	0.92 (0.80–1.07)	0.96 (0.82–1.13)	1.00 (referent)	.67	.29
Adjusted risk ratio (95% CI)	–	1.13 (0.92–1.38)	1.03 (0.87–1.22)	1.01 (0.85–1.20)	1.00 (referent)	.62	.26
One-year mortality							
Crude rate	35.6	33.5	36.1	35.7	36.1	.23	.13
Crude risk ratio (95% CI)	–	0.93 (0.86–0.99)	1.00 (0.94–1.06)	0.99 (0.93–1.05)	1.00 (referent)	.041	.034
Adjusted risk ratio (95% CI)	–	1.10 (1.02–1.19)	1.12 (1.05–1.18)	1.04 (0.97–1.11)	1.00 (referent)	<.001	.012

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