



Published in final edited form as:

Circ Heart Fail. 2012 March 1; 5(2): 160–166. doi:10.1161/CIRCHEARTFAILURE.111.963561.

Acculturation and Outcomes among Patients with Heart Failure

Pamela N. Peterson, MD, MSPH^{1,2,3}, Elizabeth J. Campagna, MS, PStat@², Moises Maravi, MS¹, Larry A. Allen, MD², Sheana Bull, PhD, MPH², John F. Steiner, MD, MPH³, Edward P. Havranek, MD^{1,2,3}, L. Miriam Dickinson, PhD², and Frederick A Masoudi, MD, MSPH^{2,3}

¹Denver Health Medical Center, Denver, CO

²University of Colorado Denver, Anschutz Medical Campus, Denver, CO

³Institute for Health Research, Kaiser Permanente, Denver, CO

Abstract

Background—Acculturation to U.S. society among minority patients may influence health outcomes beyond race and ethnicity alone. In particular, those who are foreign-born and who do not speak English as their primary language may have greater challenges interacting with the health care system and thus be at greater risk for adverse outcomes.

Methods and Results—We studied patients hospitalized with a principal discharge diagnosis of HF between January 2000 and December 2007 in an integrated delivery system that cares for minority patients. Individuals were defined as having low acculturation if their primary language was not English and their country of birth was outside of the U.S. Multivariable logistic regression and Cox proportional hazards regression were used to determine the independent risk of 30-day rehospitalization and 1-year mortality, respectively. Candidate adjustment variables included demographics (age, gender, race/ethnicity), coexisting illnesses, laboratory values, left ventricular systolic function, and characteristics of the index admission. Of 1,268 patients, 30% (n=379) were Black, 39% (n=498) Hispanic, and 27% (n= 348) White. Eighteen percent (n=228) had low acculturation. After adjustment, low acculturation was associated with a higher risk of readmission at 30 days (OR 1.70; 95% CI 1.07-2.68) but not 1-year all-cause mortality (HR 0.69; 95% CI 0.42-1.14).

Conclusions—Patients with HF who are foreign-born and do not speak English as their primary language have a greater risk of rehospitalization, independent of clinical factors and race/ethnicity. Future studies should evaluate whether culturally concordant interventions focusing on such patients may improve outcomes for this patient population.

Keywords

heart failure; readmission; survival; risk factors; health disparities

Heart failure (HF) is associated with high mortality and is a common cause of hospitalization.¹ As a result, potentially modifiable correlates of adverse outcomes among patients with HF are receiving increasing attention. However, little is known about factors

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Correspondence to Pamela N Peterson, MD, MSPH Division of Cardiology, Mail Code 0960 777 Bannock St. Denver, CO 80204
Phone: (303) 436-5663 Fax: (303) 436-7739 Pamela.Peterson@ucdenver.edu.

Disclosures Dr. Frederick Masoudi has contracts with the Oklahoma Foundation for Medical Quality and the American College of Cardiology Foundation, has previously served on an advisory board for Amgen, and as a consultant to Axio Research. Dr. Allen is supported by an American Heart Association Scientist Development Award (SDG5440013) and has served as a consultant for Amgen, Janssen Scientific Affairs, and the Robert Wood Johnson Foundation.

associated with adverse outcomes among minority patients with HF whose needs are unique and who may have risk factors beyond race/ethnicity or the traditional determinants of adverse outcomes, such as HF severity and comorbidities.²

Cultural and language differences may be important determinants of health outcomes among minority patients with chronic conditions like HF, which require frequent interactions with the healthcare system. Patients with low acculturation, or little integration into mainstream U.S. culture may have greater challenges with such interactions. For example, language barriers have a negative impact on health care experiences^{3, 4} and result in poorer recognition of and ability to communicate symptoms.⁵ Other cultural factors such as a different disease perception may also influence a patient's health care seeking behavior and the patient provider interaction.^{6, 7} At the level of care delivery, the lack of cultural competency among providers and a lack of shared decision-making may negatively influence communication and trust. All of these factors may act to limit an individual's ability to engage in practices that prevent exacerbations of HF. The relationship between low acculturation and outcomes among patients with HF, independent of race/ethnicity and traditional biological factors, has not been evaluated. Therefore, the objective of this study was to evaluate if a proxy measure of acculturation, determined using readily available sociodemographic factors of country of birth and primary language, could identify HF patients at increased risk of adverse outcomes among an underserved minority population of patients hospitalized with HF.

Methods

Study Setting and Patients

All patients were hospitalized with HF at Denver Health Medical Center (DH), an integrated delivery system in inner-city Denver, Colorado dedicated to the care of socioeconomically disadvantaged patients, many of whom are members of racial/ethnic minorities. DH is the largest vertically integrated community health center system funded by the Bureau of Primary Health Care in the United States and is nationally recognized for its model of care delivery to traditionally underserved populations.⁸ DH provides medical services (inpatient, outpatient, pharmacy) to over 140,000 persons in the Denver metropolitan area, accounting for 42% of the indigent care in Denver and 30% of the indigent care in Colorado. A clinical information system integrates information from all DH community health centers, the hospital, emergency services, pharmacies, and the clinical laboratory.

The study cohort included patients with a primary hospital discharge diagnosis for HF between January 1, 2000 and December 31, 2007, who were identified using the principal discharge diagnosis ICD-9 codes of 428.xx, 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93 or a DRG of 127. Prior literature suggests that these principal discharge diagnoses have a high positive predictive value for the diagnosis of HF compared with chart review.⁹⁻¹¹ Further, the selected ICD-9 codes have previously been shown to have high sensitivity and specificity for a diagnosis of HF in the DH system.¹²

Variables

The primary outcomes for this study were all-cause rehospitalization within 30 days and time to death from all causes within one year. Thirty-day all-cause rehospitalization was used rather than HF-specific hospitalization because it is a publicly reported quality metric by the Centers for Medicare and Medicaid Services.¹³ Hospitalizations were identified using DH claims files. We evaluated mortality using a longer 1-year time frame because the power to assess for differences using a shorter time frame was limited due to lower event rates. Mortality was ascertained from DH databases and validated by comparison with death

certificates registered with the state of Colorado. Secondary outcomes were urgent care and emergency department visits within 30 days for all causes and for heart failure. Visits were identified using DH claims files.

The primary predictor variable was acculturation. We created a variable that is a proxy for acculturation, defined on the basis of spoken language and country of birth as recorded in patient registration files.¹⁴ Individuals were defined as having high acculturation if their primary language was English or if language was missing or unknown and they were born in the United States. Individuals were defined as having low acculturation if their primary language was not English or if language was missing or unknown and their country of birth was outside of the U.S.

Potential confounding variables were selected based on prior literature and clinical relevance. The following variable domains were considered: demographics (age, gender, race/ethnicity, marital status, primary insurance); co-morbidities (history of atrial fibrillation or flutter, chronic obstructive pulmonary disease, diabetes, history of hypertension, peripheral vascular disease, coronary artery disease, prior myocardial infarction, moderate to severe valvular disease, cerebrovascular disease, dementia, cancer, history of heart failure, depression, chronic renal insufficiency and chronic liver disease); laboratory information (blood urea nitrogen (BUN), serum sodium, serum hemoglobin, and serum creatinine); left ventricular (LV) systolic dysfunction (LV ejection fraction (LVEF) < 50%); admission to the intensive care unit during index hospitalization; length of stay for index hospitalization; and discharge disposition following index hospitalization (routine, skilled nursing facility/home care services, and other).

Data on candidate predictor variables was obtained from patient registration files (sociodemographic information), claims files (diagnostic codes), laboratory files, and pharmacy files. Race/ethnicity, country of origin and primary language are self-reported by subjects when they register for care in the DH system. For subjects with unknown or missing language and missing country of birth in registration files, language was abstracted from the medical record. Data on LV systolic function was obtained by chart abstraction in all patients, and the most recent assessment was used in analyses. Diagnoses of alcohol or substance abuse were based either on ICD-9 codes or a laboratory finding of an elevated blood alcohol level or an abnormal urine toxicology screen. The sensitivity and specificity of these criteria was previously shown to be high.¹²

Statistical Analysis

Patient characteristics were compared between those with high and low acculturation using the Chi-square test for categorical variables and the Wilcoxon rank-sum test for continuous variables. The unadjusted prognostic importance of acculturation on 30-day rehospitalization was determined by univariate logistic regression. The unadjusted association between acculturation and 1-year mortality was determined by univariate Cox proportional hazards regression.

To determine the independent association of acculturation with 30-day rehospitalization, multivariable logistic regression was performed. For the outcome of 1-year mortality, multivariable Cox proportional hazards regression was used. Candidate predictors were selected *a priori* based upon existing literature and included demographic, clinical and laboratory variables.¹⁵ Variables with a p-value <0.25 in bivariate associations were considered as candidates for the models. Age, gender, race and insurance status were kept retained in the models regardless of significance. *A priori* selected variables which were not significant at the bivariate level were then tested in the models and kept if the parameter estimate for acculturation changed by ≥ 15%. The proportional hazards assumption was

verified by visually assessing Kaplan-Meier curves for dichotomous factors, and for continuous and categorical predictors with more than two levels; covariates of age, BUN, length of stay for index hospitalization, gender, race and insurance status were tested for time dependence in the Cox model. None of the covariates were time-dependent.

Continuous covariates were evaluated for the appropriateness of the linearity assumption. The functional form of predictors was estimated by categorizing each variable and plotting its parameter estimates by its respective category-specific mean. When appropriate, cut-points for continuous variables were determined from plots displaying the relationship of each individual continuous variable with the log odds of re-hospitalization. Age was included as continuous variable because of its linear relationship with log odds of re-hospitalization. Serum sodium was categorized as <135 meq/L, 135 to 140 meq/L, and >140 meq/L. Hemoglobin was categorized as <12 or ≥12 g/dL. LV systolic function was categorized as preserved (EF ≥50%) and reduced (EF <50%).

Language was missing in 6.7% of subjects. Of these, 84 (99%) were US born and were therefore classified as high acculturation, and 1 (1%) was foreign born and therefore classified as low acculturation. There were no subjects for whom both country of birth and language were unknown. In the case of LVEF, the rate of missing data was 8.3%. A separate “missing” category was created and included in the models. Missing laboratory values (missing in less than 1%) were imputed to the median value.

Although DH is highly integrated, it is not a completely closed system. Thus, a secondary analysis was performed among DH pharmacy users, who are more likely to obtain all of their care within the DH system. A DH pharmacy user was defined as someone who had two or more fills of HF medications on different dates during the study period. Additionally, we performed a sensitivity analysis including the 77 patients with no follow-up assuming that they did not experience hospitalization.

The relationship between acculturation and outcomes was also explored among prespecified subgroups including age, gender, race/ethnicity, insurance status, and LVEF. We constructed multivariable models using the modeling approach above, stratified by each of the pre-specified subgroups. The statistical significance among strata was tested with 2-way interaction terms in full models. Finally, outcomes of 30-day urgent care or emergency department visits for all causes and for heart failure were evaluated using multivariable logistic regression and the modeling approach above.

The study was approved by the Colorado Multi-institutional Review Board. All analyses were performed using SAS software (version 9.2, SAS Institute, Cary, NC).

Results

Among 1,358 patients with a principal discharge diagnosis of HF, those that did not survive hospitalization (n=11), who remained in the hospital at study close (n=2), or who had no contact with the DH system after hospital discharge (n=77) were excluded. A total of 1,268 patients were included in the analytic cohort.

Of 1,268 patients, 30% (n=379) were Black, 39% (n=498) Hispanic, and 27% (n= 348) White. Eighteen percent (n=228) had low acculturation. Those with low acculturation were more likely to be older, married, and to be members of the Colorado Indigent Care Plan, or be “self pay”. (Table 1) They were more likely to have diabetes, but less likely to have depression or documented alcohol abuse. Of those with low acculturation, over 86% were Hispanic and 70% were born in Mexico.

Within 30 days of the index admission, 194 (15%) patients were rehospitalized with 47 hospitalizations (21%) among those with low acculturation and 147 (14%) among those with high acculturation. The unadjusted odds of hospitalization at 30 days were higher for those with low acculturation (OR 1.58; 95% CI 1.09-2.26). Within one year following the index admission for heart failure, 171 (14%) deaths occurred, with 23 (10%) among those with low acculturation and 148 (14%) among those with high acculturation. In unadjusted analysis, acculturation was not significantly associated with 1-year mortality (HR 0.72; 95% CI 0.46-1.12).

The final adjusted models included age, gender, race, insurance, baseline sodium, hemoglobin and BUN, LVEF (mortality model only), history of atrial arrhythmias, hypertension, cerebrovascular disease (rehospitalization model only), discharge disposition and index hospitalization length of stay. In multivariable analysis, acculturation remained significantly associated with 30-day rehospitalization (OR 1.70; 95% CI 1.07-2.68), even after accounting for race/ethnicity. (Table 2) After adjustment, acculturation was not significantly associated with 1-year all-cause mortality (HR 0.69; 95% CI 0.42-1.14). (Table 2)

No statistically significant interactions between acculturation and other demographic factors were present for rehospitalization or mortality. Therefore, given the study sample size, we were not able to draw the conclusion that differences by demographic factors exist. (Table 3) The results were not different when the following secondary analyses were performed: including a category of US born with missing language, including age by sex interactions, further categorizing EF as <30%, and when all three changes were included in the relevant models. In addition, there was no significant association between acculturation and the secondary outcomes of urgent care and emergency department visits for all causes (OR 1.05; 95% CI 0.74-1.50) or for HF (1.22; 95% CI 0.75-1.96). When the analysis was limited to DH pharmacy users, results were consistent. Low acculturation was associated with an increased risk of rehospitalization (OR 1.92; 95% CI 1.16-3.18). There was no significant difference in mortality (HR 0.69; 95% CI 0.37-1.29). Similarly, when the analysis was performed including the 77 patients with no follow-up, assuming that they did not experience the outcome of hospitalization, the findings were consistent (adjusted OR 1.62; 95% CI 1.03-2.54).

Discussion

To our knowledge, no prior study has examined the relationship between acculturation, as defined using readily available sociodemographic variables of country of birth and primary language, and outcomes in patients with HF. In this patient population receiving care in an integrated safety-net system, low acculturation was associated with significantly higher risk for 30-day rehospitalization but was not associated with 1-year mortality. The association with rehospitalization persisted after accounting for race/ethnicity, and did not differ by age, gender, race/ethnicity or insurance status.

The study of risk factors for adverse outcomes among patients with HF has been predominantly confined to biological factors such as vital signs, laboratory values, and comorbidities.¹⁶⁻¹⁸ However, biological risk factors account for relatively little variation in readmission risk.^{17, 18} Most data regarding risk factors among patients with HF derive from clinical trials that do not include racial and ethnically diverse patient populations; studies restricted to Medicare beneficiaries; or large registry studies that do not collect detailed demographic data.^{16, 17} In addition, studies evaluating outcomes among minorities have focused primarily on race/ethnicity. Thus, while it is clear that other factors must contribute to the risk of adverse outcomes, previous studies have been unable to assess the impact of

social determinants such as acculturation, which may capture cultural and language differences.

The combination of country of birth and primary language may be thought of as a proxy for acculturation--the process by which those of a given ethnic group adopt the values, beliefs, attitudes, and behaviors of another dominant ethnic group as a result of continuous interaction with people of that dominant group.⁷ Acculturation is a complex construct and may be more fully captured by detailed multidimensional assessments. However, these scales are cumbersome; therefore they are not widely used in clinical studies and are impractical for use in busy clinical settings. Further, while perhaps an imperfect proxy for acculturation, the measure used in this analysis strongly correlates with multidimensional acculturation scales.¹⁹⁻²² The combination of the sociodemographic variables of country of birth and primary language is a simple and practical variable that provides useful information for clinical decision-making.

The effect of acculturation on health is complex and appears to be mixed; however, the net effect of the bidirectional influence of acculturation on health outcomes is largely unknown. Our findings that those with low acculturation had lower rates of COPD and alcohol abuse are consistent with the body of literature demonstrating that greater acculturation is associated with poor health behaviors. Similarly, high acculturation has been shown to be associated with a higher prevalence and worse control of cardiovascular risk factors.²³⁻²⁵ In contrast, higher acculturation predicts successful interaction with the health care system.²³ For example, higher acculturation has been shown to be associated with adherence to screening, ambulatory visits and having any prescription medications.^{23, 26, 27} This may, in part, explain our finding that acculturation was not associated with urgent care or emergency department visits. Those with low acculturation may avoid contact with the healthcare system until symptoms are severe enough to require hospitalization.

Patient centered care and cultural competence have been identified as important factors in improving quality and eliminating disparities.^{28, 29} Cultural competency has been defined as “a set of behaviors, attitudes and policies that enable a system and care providers to work effectively with individuals from diverse cultural and ethnic backgrounds.”³⁰ Recognition of cultural differences, including customs, beliefs and values, is an important component of patient-centered health care for all patients. However, for minorities cared for in a system organized and run by members of the majority group, the importance of culture is heightened and barriers may be more pronounced. Proposed techniques for increasing cultural competence include: use of interpreter services, use of community health care workers, recruitment of minority staff, training of current staff in cultural competency, inclusion of family and/or community members and coordination with traditional healers.³⁰ These and other novel techniques should be evaluated for their potential to improve care and therefore outcomes for racial and ethnic minorities with HF.

In this cohort, those who were foreign-born and non-English speaking were predominantly Hispanic of Mexican origin. While HF is a public health burden due to the high rate and cost of hospitalizations and its effect on quality of life, the public health implications of our findings are further heightened given the Hispanic population is the largest and fastestgrowing ethnic group in the U.S.³¹ Data on outcomes in Hispanics with HF is sparse. Prior studies demonstrated that Hispanics have a higher rate of hospitalization than non-Hispanic whites.^{32, 33} In contrast, Hispanics hospitalized with HF have lower rates of short term mortality; however, data on long term mortality were not presented.^{32, 33} Data on ethnic differences in the quality of care provided for patients with HF suggest that Hispanics are less likely to receive guideline recommended care.³⁴⁻³⁶ However, it is unlikely that

providing guideline recommended care is sufficient to achieve optimal outcomes among those with low acculturation.

From a policy standpoint, our findings may inform risk-stratified comparisons of readmission rates among different hospitals and health care delivery systems. Currently, factors leading to rehospitalization are poorly understood.³⁷ The finding that acculturation was associated with rehospitalization but not mortality is not surprising. Others have found little correlation between rehospitalization and mortality outcomes, suggesting that factors that promote better survival may not be working to reduce readmission.^{38, 39}

Several factors should be considered in the interpretation of our results. First, DH is widely recognized for leadership in caring for disadvantaged populations. Thus it is possible that the results of this study may underestimate the effect of low acculturation in settings less experienced in providing culturally concordant care. Second, this was a single center study and those who were of low acculturation were predominantly Hispanic of Mexican origin, which may limit the generalizability of results to immigrants from other countries who speak other languages. Third, data on primary language and country of origin were obtained from registration data. However, data contained in administrative files is obtained at the time of patient interaction with the health care system. Finally, hospitalizations may have occurred outside of DH and would not have been captured. However, secondary analyses among DH pharmacy users were consistent with our primary results.

This study demonstrates that low acculturation, as determined by country of birth and primary language, is associated with a higher risk of adverse outcomes independent of race/ethnicity, other traditional markers of disease severity and biological factors. A central tenet of quality improvement is to focus efforts on care for high-risk populations. This study justifies additional investigation focusing on improved recognition and focused, culturally concordant interventions in order to enhance outcomes for these patients. In particular, strategies to address cultural and language differences between providers and patients and optimize health care delivery to the underserved Hispanic segment of the population should be evaluated.

Acknowledgments

Dr. Pamela Peterson had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Sources of Funding Dr. Pamela Peterson was supported by an American Heart Association Pharmaceutical Roundtable grant 067001N. The American Heart Association did not have any role in the design and conduct of the study; the collection, management, analysis and interpretation of the data; or the preparation, review or approval of the manuscript.

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Table 1

Population characteristics.

	Total	Low Acculturation	All Others	p-value
	N=1,268	N=228	N=1040	
Demographics				
Age: mean (SD)	59.1 (13.9)	64.0 (14.1)	58.1	<0.001
Male %	57.6	50.0	59.3	0.010
Race/Ethnicity %				
White	27.4	6.1	32.1	
Black	29.9	2.6	35.9	
Hispanic	39.3	86.4	28.9	<0.001
Other	3.4	4.8	3.1	
Dominant Payer %				
CHS/CICP or Self Pay	39.0	49.1	36.8	
Medicaid/Medicare/Other	61.0	50.9	63.2	<0.001
Marital Status %				
Married	21.8	41.7	17.5	
Divorced	13.8	4.8	15.8	
Single	47.2	31.6	50.6	<0.001
Widowed	11.5	16.7	10.4	
Missing	5.7	5.3	5.8	
Language %				
English	75.4	0	91.9	
Spanish	15.6	86.8	0	<0.001
Other	2.3	12.7	0	
Missing	6.7	0.4	8.1	
Country of Birth %				
Mexico	13.9	69.7	1.6	
U.S.	77.2	7.5	92.5	<0.001
Russia	0.9	5.3	0	
Other	8.0	17.5	5.9	
Comorbidities %				
Atrial arrhythmia	26.3	25.4	26.5	0.733
COPD	12.1	8.3	13.0	0.052
Diabetes	55.0	64.9	52.9	<0.001
Hypertension	68.4	70.6	67.9	0.422
PVD	24.2	23.7	24.3	0.837
CAD	58.0	59.6	57.7	0.588
Prior MI	6.6	6.6	6.6	0.976
CVA/TIA	16.6	19.7	16.0	0.166
Dementia	4.4	4.8	4.3	0.740

	Total	Low Acculturation	All Others	p-value
	N=1,268	N=228	N=1040	
Cancer	9.4	9.2	9.4	0.921
History of Heart Failure	33.7	34.6	33.5	0.731
Valvular disease	29.3	32.0	28.8	0.326
Renal insufficiency	12.1	15.4	11.3	0.093
Liver disease	12.3	8.3	13.2	0.044
Alcohol/substance abuse	28.5	13.2	31.8	<0.001
Smoking (current)	5.4	1.8	6.3	0.007
Depression	33.7	27.2	35.1	0.022
Labs* mean (SD)				
Sodium mEq/L	138.4 (3.8)	138.7 (4.1)	138.4	0.178
Hemoglobin g/dL	13.2 (2.3)	12.9 (2.4)	13.2 (2.3)	0.055
Creatinine mg/dL	1.3 (1.1)	1.4 (1.3)	1.3 (11.0)	0.178
BUN mg/dL	25.3 (18.4)	28.0 (21.0)	24.8	0.016
Left Ventricular Ejection Fraction %				
Normal: 50%	36.3	48.2	33.7	
Abnormal: < 50%	55.4	46.9	57.3	<0.001
Missing	8.3	4.8	9.0	

Abbreviations: CHS= Community Health Services discount program; CICP = Colorado Indigent Care Program; COPD = chronic obstructive pulmonary disease; PVD = peripheral vascular disease; CAD = coronary artery disease; MI = myocardial infarction; CVA = cerebrovascular attack; TIA = transient ischemic attack; BUN = blood urea nitrogen

Table 2

Association between acculturation and outcomes.

Outcome	# of Patients with Event	Unadjusted Estimate (95% CI)	Adjusted Estimate (95% CI)*
30-day Rehospitalization (Odds Ratio)	194		
All others	147 (14%)	1.00	1.00
Low acculturation	47 (21%)	1.58 (1.09-2.26)	1.70 (1.07-2.68)
1-year Mortality (Hazard Ratio)	171		
All others	148 (14%)	1.00	1.00
Low acculturation	23 (10%)	0.72 (0.46-1.12)	0.69 (0.42-1.14)

* Adjusted for age, gender, race, insurance, baseline sodium, hemoglobin and BUN, LVEF (mortality model only), history of atrial arrhythmias, hypertension, cerebrovascular disease (rehospitalization model only), discharge disposition and index hospitalization length of stay.

Table 3

Relationship between acculturation and outcomes among pre-specified subgroups.

	30-day Rehospitalization		1-year Mortality	
	Odds Ratio (95% CI)	P-value *	Hazard Ratio (95% CI)	P-value *
All Patients	1.70 (1.07-2.68)		0.69 (0.42-1.14)	
By Age at Baseline		0.635		0.617
Age < 65	2.05 (1.06-3.94)		0.70 (0.27-1.79)	
Age ≥ 65	1.08 (0.53-2.15)		0.67 (0.36-1.25)	
By Race/Ethnicity		0.537		0.681
White	0.62 (0.03-3.50)		0.40 (0.05-2.96)	
Black	1.02 (0.05-7.96)		1.50 (0.19-12.16)	
Hispanic	1.59 (0.92-2.75)		0.86 (0.47-1.55)	
By Gender		0.236		0.233
Male	1.14 (0.58-2.19)		0.95 (0.49-1.88)	
Female	2.42 (1.24-4.72)		0.48 (0.22-1.04)	
By Insurance		0.154		0.440
CHS [†] /CICP [†] /SelfPay	2.13 (0.90-5.20)		0.70 (0.22-2.29)	
Medicare/Medicaid/other	1.27 (0.70-2.26)		0.74 (0.41-1.32)	
LVEF				0.200
Normal or Mild			0.44 (0.20-0.96)	
Moderate or Severe			0.96 (0.46-2.03)	

All results adjusted for age, gender, race, insurance, baseline sodium, hemoglobin and BUN, LVEF (mortality model only), history of atrial arrhythmias, hypertension, cerebrovascular disease (rehospitalization model only), discharge disposition and index hospitalization length of stay.

* test of interaction with acculturation

[†]CHS = Community Health Services discount program; CICP = Colorado Indigent Care Program