Racial and Ethnic Differences in Heart Failure Readmissions and Mortality in a Large Municipal Healthcare System

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ABSTRACT

OBJECTIVES This study sought to determine whether racial and ethnic differences exist among patients with similar access to care. We examined outcomes after heart failure hospitalization within a large municipal health system.

BACKGROUND Racial and ethnic disparities in heart failure outcomes are present in administrative data, and one explanation is differential access to care.

METHODS We performed a retrospective cohort study of 8,532 hospitalizations of adults with heart failure at 11 hospitals in New York City from 2007 to 2010. Primary exposure was ethnicity and race, and outcomes were 30- and 90-day readmission and 30-day and 1-year mortality rates. Generalized estimating equations were used to test for associations between ethnicity and race and outcomes with covariate adjustment.

RESULTS Of the number of hospitalizations included, 4,305 (51%) were for blacks, 2,449 (29%) were for Hispanics, 1,494 (18%) were for whites, and 284 (3%) were for Asians. Compared to whites, blacks and Asians had lower 1-year mortality, with adjusted odds ratios (aORs) of 0.75 (95% confidence interval [CI]: 0.59 to 0.94) and 0.57 (95% CI: 0.38 to 0.85), respectively, and rates for Hispanics were not significantly different (aOR: 0.81; 95% CI: 0.64 to 1.03). Hispanics had higher odds of readmission than whites (aOR: 1.27; 95% CI: 1.03 to 1.57) at 30 (aOR: 1.40; 95% CI: 1.15 to 1.70) and 90 days. Blacks had higher odds of readmission than whites at 90 days (aOR: 1.21; 95% CI: 1.01 to 1.47).

CONCLUSIONS Racial and ethnic differences in outcomes after heart failure hospitalization were present within a large municipal health system. Access to a municipal health system may not be sufficient to eliminate disparities in heart failure outcomes. (J Am Coll Cardiol HF 2016;4:885–93) © 2016 by the American College of Cardiology Foundation.

Racial and ethnic health care disparities are a significant problem in the United States, and eliminating disparities is a public health priority (1). Racial and ethnic disparities in cardiovascular disease care and outcomes persisted after controlling for socioeconomic status, comorbidities, and disease severity (2–4). Disparities are common in heart failure, a condition that affects 6 million Americans and remains a frequent cause of hospitalization and mortality (5,6).

Epidemiological studies conducted from the 1970s to the 1980s suggest that black patients with heart failure have rates of mortality and hospitalization similar to or higher than those of white patients (7–9). In more recent administrative and registry data, black and Hispanic patients are more likely than white patients to be hospitalized for heart failure but have lower short-term mortality (10–15). Of these recent studies, only 2 included non-Medicare patients (10,14), and only 1 study adjusted for both...
socioeconomic and clinical variables \((13)\). Hospitalizations and short-term mortality are decreasing overall for Medicare patients with heart failure, but disparities between outcomes in black patients and those in white patients are widening \((15)\). Although Asian Americans with heart failure are less studied, they have been found to have lower rates of mortality than whites and rates of hospitalization similar to those of whites \((10,13,14)\).

Despite evidence that racial and ethnic disparities persist after controlling for socioeconomic status, it is not clear whether disparities arise at the level of patients, health care providers, or health systems \((1,16,17)\).

Differences in access and quality of care may partially explain the discordance between hospitalization and mortality rates among minority patients and those of white patients \((10,18)\). Black and Hispanic patients tend to receive care at underperforming hospitals \((19,20)\) and have worse access to outpatient care \((21)\). Hospitals with higher proportions of black or Hispanic Medicare patients have higher risk-adjusted heart failure readmission rates and greater racial and ethnic disparities than hospitals that serve primarily white patients \((22,23)\). The extent to which racial and ethnic differences exist among patients with heart failure within an urban healthcare system is unknown. The purpose of this study was to determine the magnitude of racial and ethnic differences in outcomes after heart failure hospitalization among patients admitted to the municipal health system in New York City. We studied this diverse population with similar access to care to determine whether access to care eliminates racial and ethnic disparities in outcomes.

**METHODS**

We studied outcomes after heart failure acute care hospitalization stratified by racial and ethnic groups in a retrospective cohort of adults hospitalized between 2007 and 2010 within New York City Health and Hospital Corporation (HHC), the largest municipal health care system in the United States. HHC includes 11 acute care hospitals, 4 skilled nursing facilities, 6 diagnostic and treatment centers, and more than 70 community clinics \((24)\). The New York University School of Medicine Institutional Review Board approved this research.

Data sources were the HHC clinical data warehouse, the New York Statewide Planning and Research Cooperative System (SPARCS), and the New York Vital Statistics registry. Demographic and clinical data were obtained from the HHC data warehouse, which is derived from electronic health records. We obtained hospitalization details including discharge diagnosis and readmission from SPARCS, a registry of all acute nonfederal hospitalizations in New York. Post-discharge mortality was determined from the Vital Statistics registry, which contains all deaths in the state. These 3 datasets were linked using a stepwise deterministic approach with patient identifiers.

We included acute care hospitalizations for heart failure within HHC hospitals, of adults 18 years of age and older between January 1, 2007, and September 30, 2010. Heart failure was defined as principal discharge diagnosis ICD-9-CM code 428. Hospitalization cases in which the patient died or was discharged to hospice were excluded. The primary exposure was the patient’s ethnicity or race. Ethnicity and race were self-reported by patients and recorded by the admitting hospital. For patients whose hospital-recorded race and ethnicity were missing or listed as other or unknown, state-reported data were used. Patients were categorized as Hispanic, non-Hispanic white, non-Hispanic black, and non-Hispanic Asian. Due to small sample size, we excluded patients whose race was American Indian/Alaska Native, other, or unknown.

Outcomes included 30-day mortality, 1-year mortality, hospital readmission within 30 days, and hospital readmission within 90 days. Demographic variables included age and sex. Utilization and access variables included clinic visits and hospitalizations within HHC for 90 days prior to admission. Insurance status was categorized as Medicare, Medicaid, private, uninsured, and other insurance. Socioeconomic variables were estimated at the neighborhood level by using zip code-level data from the U.S. Census Bureau’s 2009 American Community Survey and included median household income and percent of high school graduates. Clinical variables included systolic blood pressure, heart rate, and creatinine and hemoglobin levels on admission. Comorbid conditions were based on discharge diagnoses by using standard algorithms \((25)\) and included diabetes, chronic kidney disease, myocardial infarction, cerebrovascular disease, peripheral vascular disease, chronic obstructive pulmonary disease, malignancy, and dementia.

**STATISTICAL ANALYSIS.** A chi-square test was used to test for differences among categorical variables among racial/ethnic groups. ANOVA was used to test for differences among continuous variables among racial/ethnic groups. Unadjusted mortality
and readmission rates were reported by race/ethnicity and were compared across categories using chi-square tests. To account for correlation related to repeat hospitalizations, we used generalized estimating equations (GEE) to test for associations between race/ethnicity and outcomes. We developed 2 GEE models: the first was an unadjusted model, and the second adjusted for all covariates as defined above, including demographics, utilization/access variables, insurance status, socioeconomic status, clinical variables, and comorbid conditions, and included a fixed-effect for the HHC hospital to which the patient presented.

We performed a secondary analysis in which we examined the outcome of total days that patients were alive and out of the hospital during the year after index hospitalization (26). We represented this outcome as means with 95% confidence intervals and calculated hazard ratios using adjusted Cox proportional hazard models. For this analysis, we used only the first hospitalization for each patient.

All tests were evaluated at a 2-sided significance level of $p < 0.05$. Stata version 13 (StataCorp, College Station, Texas) was used for all analyses.

**RESULTS**

There were 8,532 heart failure hospitalizations that met our inclusion and exclusion criteria. Of these, 4,305 (51%) were for black patients; 2,449 (29%) were for Hispanic patients; 1,494 (18%) were for white patients; and 284 (3.3%) were for Asian patients (Table 1). This cohort included 5,108 unique patients. The mean age was 67 ± 14 years, and 48% of patients were female. White patients were the oldest, with a mean age of 77 ± 13 years, compared to 65 ± 14 years for all other patients ($p < 0.0001$). In terms of insurance, 36% of patients had Medicare, 28% had Medicaid, and 16% had no insurance. Compared to white patients, black, Hispanic, and Asian patients were more likely to have Medicaid or be uninsured and less likely to have Medicare ($p < 0.0001$). Comorbid conditions were common, and all differed significantly by race/ethnicity (Table 1). For instance, Hispanic and Asian patients had higher rates of diabetes and chronic kidney disease than white and black patients ($p < 0.0001$). White patients had the highest rates of myocardial infarction and dementia ($p < 0.0001$). Black patients had the highest systolic blood pressure and heart rates on admission ($p < 0.0001$).

One-year mortality rates were 31% for whites, 20% for blacks, 24% for Hispanics, and 16% for Asians ($p < 0.0001$) (Figure 1). After risk adjustment, rates for black and Asian patients had significantly lower odds of 1-year mortality than white patients, with adjusted odds ratios (aOR) of 0.75 (95% confidence interval [CI]: 0.59 to 0.94) and 0.57 (95% CI: 0.38 to 0.85), respectively (Table 2). Although Hispanic patients had lower 1-year mortality in unadjusted analysis (OR: 0.60; 95% CI: 0.51 to 0.72), this difference did not remain statistically significant after risk adjustment (aOR: 0.81; 95% CI: 0.64 to 1.03).

Thirty-day mortality rates showed similar patterns across racial/ethnic groups: 4.4% for whites, 2.4% for blacks, 2.5% for Hispanics, and 2.1% for Asians. In unadjusted analyses, black and Hispanic patients had lower odds of 30-day mortality than white patients, with ORs of 0.53 (95% CI: 0.39 to 0.73) and 0.56 (95% CI: 0.39 to 0.80), respectively. Given the low number of deaths (6 deaths) within 30 days among Asian patients, we found no statistically significant differences between 30-day mortality rates for Asians and those for white patients, with an OR of 0.49 (95% CI: 0.21 to 1.13). After risk adjustment, we found no significant differences in 30-day mortality among groups (Table 2).

Thirty-day readmission rates were 31% for whites, 28% for blacks, 35% for Hispanics, and 23% for Asians (Figure 1). Black patients had lower unadjusted odds of 30-day readmission with an OR of 0.80 (95% CI: 0.69 to 0.93), which was not significant after risk adjustment (aOR: 1.04; 95% CI: 0.85 to 1.28) (Table 2). Hispanic patients had higher odds of 30-day readmission that did not reach statistical significance in unadjusted analysis (OR: 1.15; 95% CI: 0.97 to 1.35) but was significant after risk adjustment (aOR: 1.27; 95% CI: 1.03 to 1.57). Asian patients had lower odds of 30-day readmission than white patients (OR: 0.62; 95% CI: 0.44 to 0.89), which were no longer statistically significant after risk adjustment (aOR: 0.78; 95% CI: 0.54 to 1.12).

Ninety-day readmission rates were 49% for whites, 49% for blacks, 56% for Hispanics, and 42% for Asians (Figure 1). Although rates were similar for white and black patients, black patients had significantly higher risk-adjusted odds of readmission at 90 days than white patients, with an aOR of 1.21 (95% CI: 1.01 to 1.47). Hispanic patients had significantly higher odds of 90-day readmission (OR: 1.18; 95% CI: 1.01 to 1.37), which remained after risk adjustment (aOR: 1.40; 95% CI: 1.15 to 1.70). Odds of 90-day readmission for Asian patients were not statistically different from those of white patients, with an aOR of 0.76 (95% CI: 0.56 to 1.03) and an aOR of 1.02 (95% CI: 0.74 to 1.39), respectively.

In our secondary analysis, in which we examined the outcome of days alive out of the hospital in the
year following the index hospitalization, results were similar to those for 1-year mortality. The mean number of hospital-free days alive for white patients was 274 (95% CI: 266 to 281), 303 for black patients (95% CI: 299 to 307), 302 for Hispanic patients (95% CI: 297 to 308), and 297 for Asian patients (95% CI: 282 to 311). Compared to white patients, the adjusted hazard ratios for black, Hispanic, and Asian patients were 0.65 (95% CI: 0.52 to 0.81), 0.77 (95% CI: 0.61 to 0.96), and 0.67 (95% CI: 0.45 to 0.99), respectively.

**DISCUSSION**

We found racial and ethnic differences in mortality and readmission rates after heart failure hospitalization among a predominantly nonwhite population.
with a diverse payer mixture within a large municipal health system, which persisted after adjusting for demographic, socioeconomic, and clinical variables. At both 30 days and 1 year after hospital discharge, white patients had significantly higher unadjusted mortality rates than black, Hispanic, and Asian patients. Risk adjustment reduced the magnitude of disparities but did not eliminate them. After risk adjustment, the odds of 1-year mortality were 25% reduced for blacks and almost halved for Asians compared to those for whites. Conversely, readmissions were significantly higher among Hispanic patients at 30 and 90 days and black patients at 90 days compared to those for white patients. In summary, racial and ethnic disparities among outcomes after heart failure hospitalization were present among patients with similar access to a municipal health care system.

Our study findings are consistent with earlier findings that minority patients have lower mortality rates and higher readmission rates than white patients. Previous studies found similar differences between black and Hispanic patients and white patients, although most of these studies lacked adjustment for socioeconomic or clinical variables, or both, and only 2 studies included non-Medicare patients (10-14,22,23,27). Although our study included a relatively small number of Asian American patients, we found lower 1-year mortality but no differences in readmissions compared to white patients, consistent with previous data (10,13,14). Before our study, it remained unknown whether disparities found in administrative or registry data were representative of hospital systems that serve large minority populations with a diverse payer mix. Our study strengthens the evidence for the pattern of lower mortality and higher readmission rates for minorities than for whites by including a patient population underrepresented in previous studies and adjusting for important clinical and socioeconomic variables.

**PATHOPHYSIOLOGICAL DIFFERENCES.** Many reasons for differences in post-hospitalization outcomes have been proposed. Racial and ethnic differences in the underlying cause and pathophysiology of heart failure may contribute to differences in outcomes (6,9,14,28-36). Heart failure is commonly associated with diabetes and hypertension in black patients, whereas white patients have higher rates of coronary disease leading to ischemic cardiomyopathy (9,28-32,34,35). Similarly we found that black, Hispanic, and Asian patients had more hypertension, diabetes, and chronic kidney disease than white patients. We adjusted for comorbid conditions, blood pressure, and serum creatinine level; therefore, although these factors do not fully explain our
findings, it is possible that differences in cause may affect both mortality and readmissions. Other studies have suggested the hypothesis that minority patients hospitalized for heart failure may be healthier than whites to explain the discrepancy between lower mortality and higher readmission rates for minority patients (10,18,28,33,35). Consistent with that hypothesis and previous epidemiologic data, we found that black, Hispanic, and Asian patients were younger than white patients. Based on clinical findings and comorbid conditions, however, our data do not support the hypothesis that minority patients are healthier than white patients at the time of admission.

ACCESS TO AMBULATORY CARE. Heart failure is widely considered an ambulatory care-sensitive condition, and lack of access to ambulatory care may lead to increased hospitalization of minority patients (18,26,37,38). Black patients are more likely than white patients to seek care in emergency departments for heart failure, even when accounting for disease severity; and race, like insurance status, may be related to disposition following emergency department visit (39,40). Black patients may seek care in emergency departments due to poorer health literacy, absence of a medical home, and cost barriers to seeking care, even after controlling for income, education, insurance status, social supports, and comorbid conditions (18,41). Similarly, Hispanic patients are more likely than white patients to be at a disadvantage from lack of health insurance access, language barriers, and poor health literacy, all of which reduce access to outpatient care and portend worse outcomes (18,33). Inadequate outpatient access due to waiting lists, financial barriers, or patient perceptions may cause patients to preferentially seek emergency and inpatient care (18,38). Nonetheless, as a safety net hospital system, HHC is mandated to provide equal access to all patients, which is shown by its payer mixture (24). Furthermore, we found that minority patients were more likely than white patients to access outpatient care preceding heart failure hospitalization, although most patients of all races did not have previous clinic visits. Although the factors underlying lower clinic utilization among white patients could lead to higher mortality, our findings persisted after adjustment for clinic utilization and insurance status. As a result, we believe that access to outpatient care did not eliminate racial and ethnic differences in post-hospitalization outcomes within this municipal health system.

DIFFERENCES OR DISPARITIES. An important question is whether the differences we found represent biological, genetic, or epigenetic differences that vary

### Table 2

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>30-Day Mortality</th>
<th>1-Year Mortality</th>
<th>30-Day Readmission</th>
<th>90-Day Readmission</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unadjusted OR (95% CI)</strong></td>
<td><strong>Adjusted OR (95% CI)</strong></td>
<td><strong>Unadjusted OR (95% CI)</strong></td>
<td><strong>Adjusted OR (95% CI)</strong></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>1.00 (ref)</td>
<td>1.00 (ref)</td>
<td>1.00 (ref)</td>
<td>1.00 (ref)</td>
</tr>
<tr>
<td>Black</td>
<td>0.53 (0.39–0.73)</td>
<td>0.81 (0.49–1.33)</td>
<td>0.49 (0.41–0.97)</td>
<td>0.64 (0.55–0.72)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.56 (0.39–0.80)</td>
<td>0.75 (0.49–1.13)</td>
<td>0.50 (0.41–0.90)</td>
<td>0.69 (0.50–0.95)</td>
</tr>
<tr>
<td>Asian</td>
<td>0.49 (0.32–0.78)</td>
<td>0.69 (0.45–1.05)</td>
<td>0.43 (0.39–0.76)</td>
<td>0.50 (0.33–0.80)</td>
</tr>
</tbody>
</table>

*Adjusted model includes demographics, utilization/access variables, insurance status, socioeconomic status, clinical variables, comorbid conditions, and admitting hospital.
health equity is not an explicit goal (45,48). The Institute of Medicine defines racial and ethnic disparities in terms of “differences in the quality of healthcare that are not due to access-related factors or clinical needs, preferences, and appropriateness of intervention” (1). Although there are pathophysiological differences in heart failure by race/ethnicity, and we found differences in ambulatory care utilization, these factors do not fully explain the differences in outcomes. Racial and ethnic differences in quality metrics may be explained more by where patients receive care rather than by patient characteristics (43), and disparities in outcomes are greater in hospitals with larger proportions of minority patients (22,23). Consistent with these findings, our data suggest that disparities are present among patients within a diverse municipal health system. Therefore, we agree with those who have proposed that hospitals with large proportions of minority patients may be the ideal setting in which to study health disparities and to work toward health equity (19,20,22,23,43).

**PROMOTING HEALTH EQUITY THROUGH QUALITY IMPROVEMENT.** Although health systems cannot overcome some of the social determinants of health at the root of disparities in heart failure, targeted interventions may reduce disparities (1,4). Measuring disparities within institutions and engaging hospital leadership may be first steps toward improvement, as many leaders of minority-serving hospitals do not recognize that disparities are present within their organizations (44,45). Culturally tailored, multidisciplinary interventions that include patients and health systems may reduce disparities (4,46,47), but efforts to improve for quality for all can widen disparities if health equity is not an explicit goal (45,48). Organization-level interventions are more effective at reducing disparities than interventions targeting providers (4). Nurse-led post-discharge care can reduce readmissions and improve quality of life (4). Health information technology has the potential to address several root causes of disparities and improve chronic disease management if tailored to vulnerable populations (49).

**STUDY LIMITATIONS.** Studying outcomes stratified by race and ethnicity has inherent limitations, and we did not account for all covariates. First, our study was limited by race and ethnicity collection by hospital report, which may result in misclassification (50). Second, although HHC provides equal access regardless of ability to pay (24)—and our data showed more minority patients accessed ambulatory care—it is possible that real or perceived barriers related to primary language or immigration status, for example, may differentially affect access. Third, although all patients were seen within a single health care system, it is possible that there were unmeasured patient or treatment differences among hospitals. Fourth, electronic health records lacked patient-level data on income, education, primary language, and English proficiency, so we used ZIP code-level data as a proxy for income and education, which is a validated approach for risk-adjustment in cardiovascular disease (13,51). Fifth, data regarding ejection fraction was not available in our dataset; as a result, we were not able to adjust for risk of this important variable or stratify results by ejection fraction. Sixth, we did not have reliable discharge medication data so were unable to measure important process measures such as compliance with evidence-based therapies following hospitalization. Seventh, we were unable to account for rehospitalizations outside of New York State or within federal hospitals and deaths outside of New York State. Eighth, our data are from a single health system and may not reflect patterns at other municipal health systems or the broader population. Finally, we did not adjust for multiple comparisons, which may increase the possibility that some of our findings are due to chance.

**CONCLUSIONS**

Racial and ethnic disparities in heart failure mortality and readmissions persist within a municipal health system after risk adjustment. Our results suggest that the existence of a municipal health system is not sufficient to eliminate disparities in outcomes. Achieving health equity in heart failure outcomes may require addressing underlying social determinants of health. Nevertheless, institutions that serve large proportions of minority patients may be an ideal place to focus quality improvement efforts to reduce disparities and study interventions to reduce disparities. Improving equity in outcomes for patients with heart failure should remain a priority, and access to a municipal health system is not enough.

**ACKNOWLEDGMENT** The authors thank Yan Ro-sentsveg, New York City Health and Hospitals Corporation, for assistance with obtaining the data used in this study.

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Municipal Heart Failure Outcomes by Race/Ethnicity

COMPETENCY IN MEDICAL KNOWLEDGE: Racial and ethnic disparities in the outcomes of patients with heart failure are present within a diverse municipal health system after adjusting for covariates. In clinical care of patients with heart failure, it is important to recognize that disparities are present and actively apply strategies to achieve the best possible clinical outcomes for patients. Quality improvement efforts can address health systems challenges that disproportionately impact vulnerable patient populations.

REFERENCES


TRANSLATIONAL OUTLOOK: The next step in disparities research is to test specific strategies to address racial and ethnic disparities. Ongoing research is still needed to determine whether quality improvement efforts motivated by shifts toward public reporting and paying for value in health care increase or decrease disparities in outcomes, particularly for vulnerable patient populations. Finally, evidence is needed on how to implement and broadly disseminate interventions that effectively reduce disparities at the hospital and health systems levels.


KEY WORDS: ethnicity, health disparities, heart failure, morbidity, mortality, outcomes research.