Impact of Ethnicity, Sex, and Socio-Economic Status on the Risk for Heart Failure Readmission: The Importance of Context

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Background: Hispanics are a fast-growing minority in the United States and have a high risk for the development of heart failure (HF). Hispanics have higher HF-related hospital readmission rates compared with non-Hispanics. However, the risk of readmission in a largely disadvantaged and majority Hispanic population has not been evaluated.

Methods: We analyzed data for patients discharged with a principal discharge diagnosis of HF from the University of New Mexico Hospital from 2010–2014. Student t-test and chi-square analysis were used to assess the unadjusted associations between baseline characteristics and 30-day readmission rate. Multivariable logistic regression modeling evaluated the associations between 30-day hospital readmission rate, socio-demographic characteristics, and clinical variables.

Results: A total of 1,594 patients were included in our analysis. Mean age (SD) was 63.1 ± 14 and 62.9 ±13.8 (P=.07) for Hispanics and non-Hispanics, respectively. Sixty percent of Hispanics had HF with reduced ejection fraction compared with 53.9% of non-Hispanics (P=.012). In unadjusted analysis, Hispanic ethnicity was associated with a two-fold increase in HF readmission rate compared with non-Hispanic ethnicity (OR 2.0, 95% CI 1.5–2.7). In fully adjusted models, Hispanic ethnicity showed an 80% increase in HF readmission rate compared with non-Hispanic ethnicity (OR 1.8, 95% CI 1.2–2.6).

Conclusion: Among patients from a socioeconomically disadvantaged background living in a Hispanic-majority area, being Hispanic is associated with higher odds of 30-day hospital re-admission after adjusting for demographic, clinical and socioeconomic covariates. Our findings show that further research is needed to understand disparities in Hispanic's heart failure-related outcomes. *Ethn Dis.* 2018;28(2):99-104; doi:10.18865/ed.28.2.99.

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Introduction

Hispanics are a fast-growing minority in the United States and have a high prevalence of cardiovascular risk factors.[1,2] Despite high rates of obesity, diabetes, hypertension, and chronic kidney disease, cardiovascular mortality among Hispanics is lower than non-Hispanics.[3,4] This finding is commonly referred to as the Hispanic paradox.[5] In regard to the Hispanic paradox, little data exist to describe cardiovascular disease-specific morbidity and mortality for Hispanics in the United States.[6] Despite the described resilience[7] and lower general mortality among Hispanics,[8,9] heart failure risk, prevalence, and associated morbidity remain significant in this population.[10]

Hospital data show that older Hispanics with heart failure have higher heart failure-related hospitalization and readmission rates compared with non-Hispanics.[11] Hospital mortality is lower in Hispanics with heart failure with preserved ejection fraction (HFpEF) when compared with non-Hispanics.[8] However, this survival advantage is not present in Hispanic patients with heart failure with reduced ejection fraction (HFrEF).[8] Hispanics are more likely to be younger, obese/overweight, and to have high rates of diabetes and hypertension; these factors increase the risk for poor heart failure outcomes.[8,10] Although comorbidities contribute to higher mortality and readmission rates in all patients,[12] medical comorbidities alone do not fully account for heart failure hospitalization.[9] Socioeconomic status has been associated with incidence of heart failure and adverse outcomes[13] as well as higher hospital readmission rates in the general population.[14,15] Despite higher poverty rates, less education, and poorer access to health care, Hispanics have better or equal health outcomes compared with non-Hispanic Whites,[16,17] consistent with the Hispanic paradox.

Hospital readmission rates are

associated with poor health outcomes in heart failure patients. The 30-day readmission rates in a majority Hispanic population in a socioeconomically depressed environment (with low education levels and low incomes) have not been previously described. In our study, we aimed to evaluate risk factors associated with the 30-day hospital readmission rate in heart failure patients from a socioeconomically disadvantaged background.

Methods

Data were collected on consecutive patients with a principal diagnosis of heart failure who were discharged alive from the University of New Mexico Hospital from January 2010 thru December 2014. Patients' sociodemographic characteristics, medical comorbidities, left ventricular ejection fractions, and multiple laboratory measures were collected at the time of hospital discharge. Sociodemographic variables included self-reported race and ethnicity, age, and sex. Poverty level, education level, and distance of home from the hospital (which will be referred to as ZIP code-related socioeconomic characteristics) were assessed from the patients' home ZIP codes. Poverty level and educational level were obtained from Census 2010 data; they were defined as, respectively, the percent of households below the federally determined poverty level and the percent of adults with less than high school education in a patient's ZIP code. Distance from hospital was calculated using the distance between the University of New Mexico Hospital's address and a patient's ZIP code.

Baseline characteristics collected at the time of hospital discharge were described using means (±SD) for continuous variables and frequencies for categorical variables. Student's *t*-test and chi-square analysis were used to assess unadjusted associations between baseline characteristics and 30-day readmission rate. Multivariable mixed effects logistic regression modeling evaluated the associations between 30-day hospital readmission rate, sociodemographic characteristics, and clinical variables using ZIP code as a random effect. Our final model included all variables found to be significantly associated with the primary outcome variable in univariable analysis: self-reported Hispanic ethnicity, sex, diabetes, hypertension, beta-blocker prescription at discharge for index admission, preserved ejection fraction (EF), chronic kidney disease (CKD, defined as serum creatinine ≥ 1.5), log-transformed driving distance, inversely transformed education level, and inversely transformed poverty level.

We aimed to evaluate risk factors associated with the 30-day hospital readmission rate in heart failure patients from a socioeconomically disadvantaged background.

Results

A total of 1,608 patients with initial diagnosis of heart failure were discharged from UNM from January 2010 to December 2014. There were 777 patients self-reporting Hispanic ethnicity; 817 patients self-reporting non-Hispanic ethnicity; 14 patients did not provide ethnicity data. Overall mean age (SD) was 63.1 ± 14 years; there was no significant age difference between Hispanics and non-Hispanics (62.9 ±13.8, 63.2 ±14.3 years, respectively; P=.07). The distribution of type of heart failure varied between the two groups: HFrEF was more prevalent in Hispanics compared with non-Hispanics (60.1%, 53.9%, respectively, P=.01). At index HF admission, 58.4% of patients were men and 41.6% were women. Among women discharged from the hospital with initial diagnosis of HF, 41.4% had HFrEF and 58.6% had HFpEF. Among men discharged with initial HF diagnosis, 68.2% had HFrEF and 31.8% had HFpEF. Finally, the observed 30-day readmission rate was 13.4% and the readmission rate was higher for Hispanics than for non-Hispanics (17.5% vs. 9.6%, respectively; P<.001). (Table 1)

Among the comorbid conditions analyzed, diabetes was more prevalent in Hispanics compared with non-Hispanics (54.7% vs. 42.5%, respectively; P<.001). Hypertension and

Table 1. Baseline characteristics of patients discharged with principal diagnosis of heart failure from University of New Mexico Hospital, 2010 - 2014

	All, n= 1594	Hispanic, n= 777	Non-Hispanic, n= 817	P
Age years, mean ± SD	63.1 ± 14	62.9 ± 13.8	63.2 ± 14.3	.07
Female, n (%)	667 (41.6)	309 (46.6)	354 (53.4)	.15
Admission weight in kg, mean ± SD	96.3 ± 45	95.2 ± 51.2	97.3 ± 38.7	.42
Heart failure				
HFrEF, n (%)	907 (56.9)	467 (60.1)	440 (53.9)	.01
Comorbidities				
Hypertension, n (%)	1088 (68.3)	543 (69.9)	545 (66.7)	.17
Diabetes, n (%)	772 (48.4)	425 (54.7)	347 (42.5)	<.001
CKD, n (%)	634 (39.8)	314 (40.4)	320 (39.2)	.61
Laboratory data				
Albumin, mean ± SD	3.0 ± 0.5	2.94± 0.5	3.1 ± 0.5	.20
Serum Cr, mean ± SD	1.7 ± 3.7	1.5± 2.3	1.8 ± 4.5	.20
NT proBNP, mean ± SD	10088 ± 15871	9789.7 ± 14864.3	10378.7 ± 16794.5	.47
Medications				
Beta blockers, n (%)	862 (57)	456 (62.5)	406 (51.9)	<.001
30-day readmissions, n (%)	214 (13.4)	136 (17.5)	78 (9.6)	<.001

CKD, chronic kidney disease; Serum Cr, serum creatinine; NT proBNP, B-type natriuretic peptide.

CKD were equally prevalent in both groups. Albumin, serum creatinine level, and B-type natriuretic peptide (BNP) level on admission were similar between the two groups as well. At the time of discharge, 62.5% Hispanic patients were prescribed beta-blockers compared with 51.9% non-Hispanics (P<.001). (Table 1)

On univariate analysis, Hispanic ethnicity (OR 2.0, 95% CI 1.5–2.7), HFpEF (OR 2.0, 95% CI 1.5–2.7), and CKD (OR 2.1 95% CI 1.6–2.8) conferred a two-fold increase in the odds of 30-day hospital readmission. Age on admission to the hospital was not associated with 30-day readmission rate (OR 1.03 95% CI 0.88–1.2). Female sex was associated with a 60% increase in the odds of 30-day readmission (P=.002). Finally, all measures of socioeconomic status (SES), except for household income, were associated with increased risk of 30-day hospital readmission (Table 2).

After adjusting for comorbidities and ZIP code-related SES characteristics, Hispanic ethnicity (OR 1.8, 95% CI 1.2–2.5) and female sex (OR 1.6, 95% CI 1.1–2.2) were significantly associated with of 30-day readmission risk on multivariable logistic regression modeling. HFpEF compared with HFrEF was not significantly associated with 30-day readmission risk after adjusting for comorbidities and ZIP code-related SES. Among the various ZIP code-related SES characteristics, only the distance of home from hospital (OR 8.7, 95% CI 1.9–88) was significantly associated with 30-day readmission.

Discussion

Among heart failure patients from an ethnically and socioeconomically disadvantaged environment where poverty rates are high and education attainment is low, Hispanic ethnicity, female sex, and living further from the hospital were significantly associated with higher 30-day readmission rate. The crude odds for readmission varied after adjusting for clinical, demographic, and socioeconomic markers. Our findings suggest that socioeconomic factors, by themselves, may not meaningfully impact HF readmission rates in our patient population. However, variability in this risk by the socioeconomic environment, represented by ZIP code in this analysis, suggests that these factors in combination, as well as other unmeasured factors associated with ZIP code, may still meaningfully affect the 30-day readmission rate.

Our study is unique in that we provide data on heart failure 30-day readmission risk of a population living in a socioeconomically disadvantaged environment and where individuals from Hispanic background comprise approximately 50% of the state population. Eth-

nic density, defined as the proportion of ethnic minority residents in a defined geographic area, has been associated with poor health care outcomes.[18–20] However, the data on the effects of ethnic density vary by ethnicity.[21] Hispanics appear to have more consistent positive health care outcomes compared with other ethnicities. For example, Hispanics living in neighborhoods with a high density of Hispanics have lower mortality rates,[22] lower cancer and stroke rates but high diabetes and low physical activity levels.[20] There is, however, a paucity of data evaluating the impact of living in a high Hispanic density environment and heart failure outcomes. Our findings show that despite living in an environment where Hispanic ethnicity represents the majority of the population, being from a Hispanic background confers an increased risk for hospital readmission independent of area level SES. This finding suggests the existence of an underlying health disparity not explained by SES.

Our findings suggest that socioeconomic factors, by themselves, may not meaningfully impact HF readmission rates in our patient population.

Table 2. Univariate association with 30-day readmission rate

	OR	95% CI	P
Hispanic ethnicity	2.0	1.5-2.7	<.001
Age	1.0	.88-1.2	.66
Female compared with male	1.6	1.2-2.1	.002
HFpEF compared with HFrEF	2.0	1.5-2.7	<.001
Comorbidities			
Hypertension	1.3	.9-1.8	.06
Diabetes	1.2	.9-1.5	.32
CKD	2.1	1.6-2.8	<.001
Socioeconomic measures			
Distance of home from hospital, miles	4.4	1.7-11.3	.002
Household income	.6	.4-1.1	.09
Level of education	1.9	1.0-3.6	.05
% below poverty level	5.4	1.1-27.5	.04

CKD, chronic kidney disease; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction.

We found a higher prevalence of HFrEF among Hispanics compared with non-Hispanics. Surprisingly, while in the univariable analysis, HFpEF conferred a two-fold increase in the odds of 30-day readmission rate, in our final multivariable model after adjusting for comorbidities and socioeconomic variables, heart failure type was not significantly associated with 30-day readmission rate. Therefore, we must gain further understanding of the factors associated with higher 30-day readmission rates in patients with HFpEF to develop more effective re-hospitalization preventive measures. While continued efforts to understand the various HFpEF phenotypes from a pathophysiologic perspective are necessary,[23] a focus on non-traditional cardiovascular risk factors as well as social and cultural population characteristics will likely aid the development of readmission prevention strategies.

The prevalence of diabetes was higher in Hispanics than in non-Hispanics, consistent with previous reports.[8] In unadjusted analysis, diabetes was not associated with 30-day re-admission rate, and although the strength of the association increased in multivariable analysis, this finding did not reach statistical significance. Diabetes may still likely play a role in readmission risk for Hispanics, but it is the combination of medical comorbidities and SES that drive the significance of association between Hispanic ethnicity and 30-day readmission rate. However, after adjusting for these potential confounders and the place of residence (ZIP code), the odds ratio for Hispanic ethnicity did not significantly change.

Different from previous studies,[8] hypertension and chronic kidney disease were equally prevalent in both Hispanics and non-Hispanics. Only chronic kidney disease was significantly associated with 30-day readmission rate; however, the significance of the association decreased after adjusting for other comorbidities and SES. This finding suggests that although chronic kidney disease plays a critical role in heart failure patient outcomes, readmission risk

is associated with a more complex set of characteristics that include social and environmental factors.

Our study limitations include the use of ZIP codes as a surrogate for population-level, but not individual-level, measures of SES. However, ZIP code-related socioeconomic characteristics provide a reasonable estimation of the socioeconomic environment for the individuals included in this analysis. Future goals include data analysis adjusting for patient-specific measures of SES. Generalizability of findings to other populations is also a study limitation; our findings are specific for the Hispanic population in the state of New Mexico. Nonetheless, our findings might represent heart failure outcomes for US Hispanics who have undergone a more extensive bilateral acculturation process.

Conclusion

Among heart failure patients from a socioeconomically disadvantaged background living in an area where Hispanic ethnicity is the majority group in the population, Hispanic ethnicity is associated with higher odds of 30-day hospital re-admission after adjusting for comorbidities as well as ZIP code-related socioeconomic characteristics. Our findings illustrate the need to continue efforts to understand how factors related to Hispanic ethnicity drive this disparity.

Conflict of Interest

No conflicts of interest to report.

Author Contributions

Research concept and design: Ponce, Norris, Cox, Laskey; Acquisition of data: Dodendorf, Martinez, Cox, Laskey; Data analysis and interpretation: Ponce, Norris, Dodendorf, Laskey; Manuscript draft: Ponce, Laskey; Statistical expertise: Ponce, Norris, Laskey; Administrative: Ponce, Norris, Dodendorf, Martinez, Cox; Supervision: Laskey

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