Racial Disparities in Hospitalizations, Procedural Treatments and Mortality of Patients Hospitalized with Atrial Fibrillation

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Objectives: To explore racial differences in characteristics, procedural treatments, and mortality of hospitalized atrial fibrillation (AF) patients.

Background: Despite a higher burden of AF risk factors, Black individuals have a lower prevalence of AF than their White counterparts. There is suggestion that AF may go undetected in minority groups, and there may be disparities in both diagnosis and treatment of AF.

Methods: The study sample was drawn from the Healthcare Cost and Utilization Project database created by the Agency for Healthcare Research and Quality. Outcomes included AF hospitalization rate, in-hospital procedures performed, and in-hospital mortality within 6 defined sex-race subgroups: Black males, Black females, White males, White females, other males, and other females.

Results: 165,319 hospitalizations (41% White male, 41% White female, 4% Black male, 4% Black female, 5% other male, 5% other female) with a primary discharge diagnosis of AF were identified. Black males and females were significantly younger than White patients and had more traditional and non-traditional risk factors. Black males and females were significantly less likely to have an ablation procedure or cardioversion than White males. Black race was an independent predictor of in-hospital mortality (Odds Ratio [95% CI] of 1.90 [1.5, 2.5] for Black males and 1.38 [1.1, 1.8] for Black females).

Conclusion: Using a large, contemporary sample of inpatients, we found significant racial differences in baseline characteristics, treatments, and outcomes of patients hospitalized with AF. There appear to be important racial disparities in the care of minorities who are hospitalized with AF that require further investigation. (*Ethn Dis*. 2014;24[2]:144–149)

Key Words: Racial Disparities, Hospitalizations, Atrial Fibrillation

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Introduction

Atrial fibrillation (AF) is the most common arrhythmia in the world, with approximately 4 million individuals carrying the diagnosis in the United States alone.[1] Despite having a higher burden of AF risk factors and the highest stroke risk of all racial and ethnic groups,[2] studies have shown that Black individuals have a lower prevalence of AF than their White counterparts[2,3] There is suggestion that AF may go undetected in minority groups, contributing to these findings. When the diagnosis is made, White patients are 3 times as likely as Black patients to be aware of having AF and 4 times as likely as Blacks to be treated with warfarin.[4] These data suggest that, as seen in other cardiovascular conditions, there may be disparities in both the diagnosis and treatment of AF.

While there have been some studies looking at the impact of race on AF in the general population, little is known regarding the impact of race on the characteristics and outcomes of those hospitalized with AF. Furthermore, there are no data on the racial prevalence of in-hospital procedures commonly performed for symptom management. Using data from the Healthcare Cost and Utilization Project (HCUP), we explored racial and sex differences in hospitalizations, procedural treatments, and mortality for an index AF hospitalization.

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Using data from the Healthcare Cost and Utilization Project (HCUP), we explored racial and sex differences in hospitalizations, procedural treatments, and mortality for an index AF hospitalization.

Methods

Study Population

The study sample was drawn from the Nationwide Inpatient Sample (NIS) of the Healthcare Cost and Utilization Project (HCUP) database created by the Agency for Healthcare Research and Quality (AHRQ). It is the largest collection of longitudinal all-cause and all-payer patient hospitalization data in the United States. The NIS dataset includes 1051 hospitals (representing a 20% stratified sample of US community hospitals) located in 46 states (representing 96% of the US population).[5] Hospitalizations with a primary discharge diagnosis of AF at an acute-care facility between January 1, 2009 and December 31, 2010 were included. Approximately 14% of these hospitalizations were missing race and ethnicity data and were excluded from the study sample. We further excluded any cases with missing sex information. There were no remarkable differences in patient age, sex, or in-hospital mortality between patients with and without race

information (70.0 vs 69.6 for mean age, 49.8% vs 50.4% female, and .76% vs .86% in-hospital mortality, all $P>.05$). There was no clinically significant difference in comorbidities. Analyses were conducted for all patients aged ≥15 years with a principal discharge diagnosis of AF based on the International Classification of Diseases, Ninth Revision, Clinical Modification ([ICD-9-CM] code 427.31 and 427.32).

Outcomes and Patient Characteristics

Our outcomes included AF hospitalization rate, in-hospital procedures performed, and in-hospital mortality. The AF hospitalization rate was calculated using the total number of AF hospitalizations divided by the total all-cause hospitalizations. Procedural treatments included electrical cardioversion, surgical ablation, and non-surgical ablation procedures. In-hospital mortality was defined as all-cause death during an index AF hospitalization.

Patient demographics included age, sex, and race. Using the race and sex information in the NIS dataset, we defined 6 sex-race subgroups: Black males, Black females, White males, White females, other males, and other females. This approach allowed us to account for interactions between race and sex that were remarkable for our outcomes. Because there was variation in how states documented ethnicity, we used the other term to categorize those who identified themselves as Hispanic, Asian, Pacific Islander, Native American, or other. Patient demographics included age and sex. Comorbidities included alcohol use, illicit drug use, obesity, history of heart failure, stroke, diabetes mellitus (DM), hypertension (HTN), chronic obstructive pulmonary disease (COPD), depression, peripheral vascular disease, valvular heart disease, history of acute myocardial infarction, history of stroke, chronic kidney disease, pregnancy, and/or metastatic cancer. Pertinent comorbidities were defined by the AHRQ definitions and then extracted from the HCUP datasets available at http://www.hcupus.ahrq.gov/toolssoftware/comorbidity/comorbidity.jsp.

Statistical Analysis

Atrial fibrillation hospitalization, mortality, and discharge disposition rates were expressed as a percentage. We conducted descriptive and bivariate analyses to evaluate the sex-race differences in patient characteristics and outcomes. We used the Chi-square test to compare dichotomous and categorical variables, and the Cuzick nonparametric test for continuous variables. We fitted a generalized linear mixed model with a logit link function and hospital-specific random intercepts to evaluate the effect sizes of racial disparities in AF hospitalizations, adjusting for patient age and comorbidities. We included 5 dummy variables: White-female, Black-male, Black-female, other-male, and other-female in the model and the White-male subgroup was used as a reference. We fitted the same model for in-hospital procedures and mortality. All statistical testing was 2-sided, at a significance level of .05, and all analyses were conducted using SAS 64-bit version 9.3 (SAS Institute Inc., Cary, NC). Institutional Review Board approval was obtained through the Brigham and Women's Hospital Human Investigation Committee. Patient confidentiality was protected through a data use agreement with AHRQ.

RESULTS

Baseline Patient Characteristics

A total of 165,319 hospitalizations (50.4% female) with a primary discharge diagnosis of AF were identified. Baseline characteristics are shown in Table 1. Black females had the highest rates of obesity (20%) and HTN (76%) while Black males had the highest rate of chronic kidney disease (24%). Black males had a substantially higher prevalence of alcohol (10%) and illicit drug (8%) use among those diagnosed admitted with AF. Depression was particularly prevalent among White females (10%). The three most common comorbidities associated with AF were HTN, DM, and COPD for White males; HTN, COPD, DM for White females; HTN, DM, chronic kidney disease for Black males; HTN, DM, COPD for Black females; HTN, DM, COPD for other males; and HTN, DM, COPD for other females. Black males were the youngest at admission (mean age 59) and White females, who carried the greatest burden of hospitalization, were the oldest (mean age 75). In a risk-adjusted model, White males had the highest hospitalization rate until later in life at which time White females carried the greatest burden of AF hospitalization (Figure 1).

In-Hospital Procedure Rates

Nearly 8% (7.8%) of Whites vs 6.6% of Black and 5.9% of other patients received an ablation procedure. Table 2 shows in-hospital procedural odds ratio by race/ ethnicity and sex. Racial and ethnic minority females had the lowest rates of in-hospital procedures. Other and Black females were much less likely to have a cardioversion performed (9 and 10% respectively) as compared to White males who had the most (19%). Ablations were also least likely to be performed in other and Black females. Black and other males were less likely than their White counterparts to have cardioversion or an AF ablation procedure performed.

Mortality Rates

Figure 2 shows mortality rates for each group, as compared with White males during an index AF hospitalization. After controlling for age and covariates, Black males were 90% more likely than White males to die during the index hospitalization (OR 1.90, 95% CI 1.50–2.50). Other females

Table 1. Baseline characteristics of patients admitted with a primary diagnosis of atrial fibrillation by race and sex

	White Men (*n*=67,738)	White Women (*n*=69,243)	Black Men (*n*=6,280)	Black Women (*n*=6,387)	Other Men (*n*=7,940)	Other Women (*n*=7,731)	*P*
% of total	40.97%	41.88%	3.80%	3.86%	4.80%	4.68%	
Age, years	67	75	59	67	63	71	
Interquartile range, age	58–77	67–84	49–70	57–79	53–75	62–82	
Comorbidities, *n* (%)							
Alcohol abuse	4,436 (6.55)	743 (1.07)	632 (10.0)	117 (1.83)	681 (8.6)	64 (.83)	.001
Depression	3,897 (5.75)	7,099 (10.25)	217 (3.46)	379 (5.93)	326 (4.11)	584 (7.55)	.001
Diabetes	16,219 (23.94)	15,379 (22.21)	1,911 (30.43)	2,258 (35.35)	2,343 (29.51)	2,529 (32.71)	.001
Hypertension	41,831 (61.75)	47,110 (68.04)	4,509 (71.80)	4,845 (75.86)	5,034 (63.4)	5,403 (69.89)	.001
Metastatic cancer	1,184 (1.75)	858 (1.24)	95 (1.51)	78 (1.22)	110 (1.39)	82 (1.06)	.001
CKD	7,462 (11.02)	7,070 (10.21)	1,497 (23.84)	1,358 (21.26)	1,061 (13.36)	879 (11.37)	.001
COPD	14,133 (20.86)	15,572 (22.49)	1,183 (18.84)	1,404 (21.98)	1,247 (15.71)	1,424 (18.42)	.001
Drug abuse	886 (1.31)	258 (.37)	487 (7.75)	117 (1.83)	219 (2.76)	28 (.36)	.001
Obesity	8,796 (12.99)	7,967 (11.51)	934 (14.87)	1,261 (19.74)	847 (10.67)	919 (11.89)	.001
PVD	4,695 (6.93)	4,413 (6.37)	354 (5.64)	430 (6.73)	396 (4.99)	398 (5.15)	.001
Valvular disease	97 (.14)	150 (.22)	10 (.16)	13 (.20)	12 (.15)	10 (.13)	.02
CAD	1,009 (1.49)	1,147 (1.66)	85 (1.35)	105 (1.64)	93 (1.17)	125 (1.62)	.006
H/O stroke	1,208 (1.78)	1,487 (2.15)	63 (1.00)	83 (1.30)	120 (1.51)	146 (1.89)	.001

CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; PVD; peripheral vascular disease; CAD, coronary artery disease; H/O, history of.

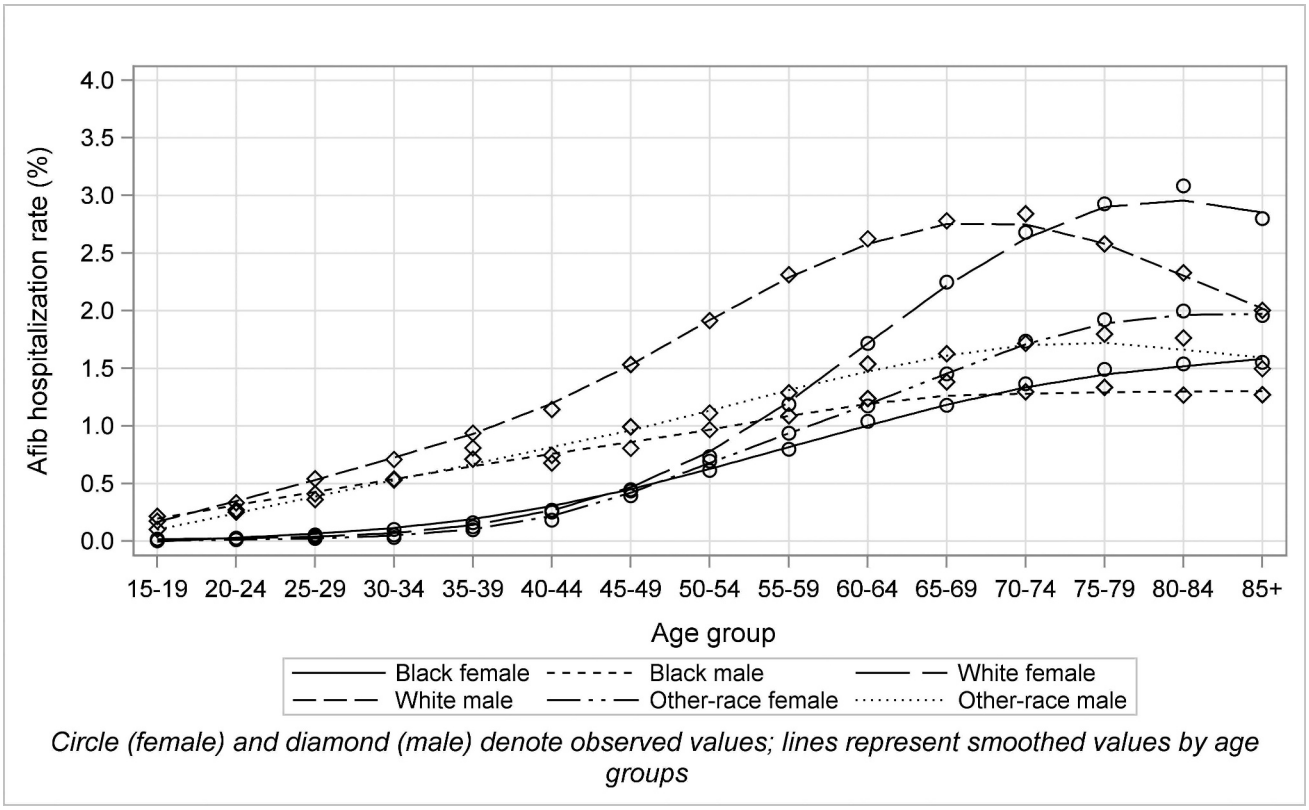

Fig 1. Risk-adjusted odds ratio of atrial fibrillation hospitalizations by race, ethnicity, and sex

Table 2. Procedural odds ratio of patients admitted with a primary diagnosis of atrial fibrillation by race and sex[a]

	Surgical Ablation OR (95% CI)	Catheter-Based Ablation OR (95% CI)	Cardioversion OR (95% CI)
White male (reference)	1.00	1.00	1.00
White female	.56 (.50–.72)	.58 (.55–.60)	.71 (.69–.73)
Black male	.37 (.22–.63)	.80 (.72–.88)	.61 (.57–.66)
Black female	.11 (.04–.30)	.44 (.39–.50)	.44 (.41–.48)
Other male	.79 (.56–1.10)	.70 (.65–.77)	.70 (.66–.75)
Other female	.26 (.14–.48)	.38 (.34–.43)	.47 (.43–.50)

[a] All groups, except other males, had statistically significantly less procedure rates as compared to White males.

had the second highest mortality rate as compared with White males (1.50, 1.20–1.90). Black females also faced statistically higher mortality rates as compared with White males (1.38, 1.10–1.80).

DISCUSSION

Although the comorbidities associated with AF in our population were similar across all sex, racial, and ethnic groups, hospitalized Black males and females had the highest prevalence of AF risk factors. Black males and females had a disproportionate diagnosis of obesity, hypertension, chronic kidney disease, and DM,[6–8] yet made up a small percentage of AF hospitalizations. This is consistent with previous reports showing a lower prevalence of AF in the Black population despite a higher prevalence of AF-associated risk factors.[9] Although there are studies that suggest there may be an underrecognition of AF in Black patients,[4] genetics may be a key driver of the AF burden seen in Whites. In fact, genetics appears to play a much greater role in the diagnosis of lone AF than do identified risk factors and several single nucleotide polymorphisms that have been identified in those of European descent.[10]

It is unclear what role, if any, a genetic predisposition to AF plays in Black patients. Atrial fibrillation risk factors may have a greater influence in this group, in which case the emphasis should be placed on risk factor modification for both the prevention and management of AF. Given that the risk of stroke encompasses much of the concern with AF, it is also important to elucidate potential differences in the pathophysiology of stroke between White and Black patients. Black patients have significantly higher stroke rates and stroke mortality than their White counterparts.[11] However, our study showed that of those patients with AF, a history of stroke was highest in White females. This suggests that other stroke risk factors such as hypertension and DM may play a bigger role than AF in the incidence of stroke in Black patients. A recent study by Howard et al[11] showed that the increased incidence of stroke in Blacks can be largely attributed to hypertension, diabetes, and socioeconomic factors. The study also showed that nontraditional risk factors such as obesity, sleep apnea, stress and depression may also be significant contributors to stroke risk in Blacks.

It is worth noting that there were significant psychiatric comorbidities in the subgroups analyzed. Black males had a particularly high rate of illicit drug and alcohol use. While alcohol has been studied in AF, little has been done regarding the relationship between illicit drug use and AF. However, both have been implicated as an etiology of AF in younger patients.[12,13] This may in fact be one of the explanations for the younger age of admission that we saw in Black males in our study. White and other females had a very high prevalence of depression. It is unclear if depression triggers AF or vice versa, but it has been shown to significantly impair the quality of life of patients with AF.[14] Given that our cohort had a primary discharge diagnosis of AF and were therefore presumably symptomatic, depression and anxiety likely have an even greater impact. Going forward, the impact of psychiatric comorbidities in AF prevalence and outcomes will require further investigation.

Given the substantial impact symptomatic AF has on the quality of life of patients and the known relapse rate with pharmacologic treatments to maintain sinus rhythm, ablation procedures are increasingly used to restore and maintain sinus rhythm. Our study showed

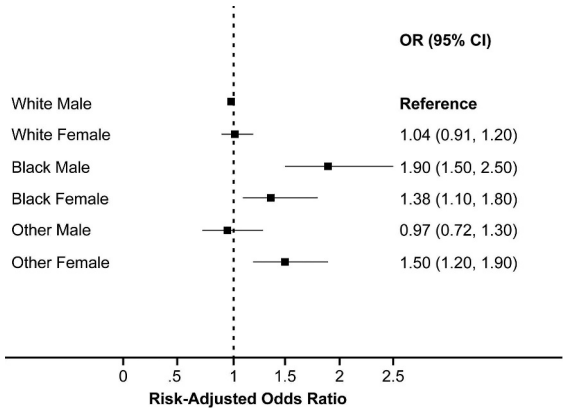

Fig 2. Risk-adjusted odds ratio for in-hospital mortality by race, ethnicity, and sex

that Black and other patients were less likely than White patients to receive an ablation procedure or cardioversion. There was also significant variation by sex with females being much less likely than males to have these procedures performed. This disparity could be partially related to the increased comorbidities in the minority groups, potentially deeming them too sick for an invasive procedure. Females hospitalized with AF are known to have more comorbidities, largely due to their advanced age at presentation, which would be consistent with this hypothesis. It should be noted that this finding is in contrast to that of a study by Kneeland et al in 2009[15] describing the trends in catheter ablation over the last 15 years which showed no statistically significant difference in catheter ablation rates between males and females.

If certain groups are in fact poor candidates for invasive procedures, one would still expect a comparable rate of cardioversion within all groups. However, our data show that Whites were far more likely to receive a cardioversion than Blacks. These results follow a similar sex pattern as seen for ablation procedures. It should be noted that our sample does not take into account re-hospitalization of the same patient. This is an important point given certain groups may have higher procedures as a result of higher re-hospitalization rates and failure of medical management. The reasons for these differences in procedure rates are unclear and will need further investigation.

In our risk-adjusted model, Black males were 90% more likely than White males to die during the index hospitalization for atrial fibrillation.

The most striking finding is the difference in mortality rates between Black and White patients. In our risk-adjusted model, Black males were 90% more likely than White males to die during the index hospitalization for AF. This was followed by other and Black females. It is unclear whether race itself is the explanation for these findings or is a surrogate for socioeconomic status or other intermediary variables. Research has suggested that there may be a racial bias in the quality of care received by Black vs White patients.[16] There are data indicating that it may be the quality of care that minorities have access to and not racial discrimination that is the driving factor. Studies have shown that Black patients are more likely to be admitted with a myocardial infarction to hospitals deemed high mortality and treated by physicians with less clinical training than their White counterparts.[17,18] Therefore, this may be a quality of care issue rather than a racial disparity in AF treatment.

LIMITATIONS

There are a number of limitations to our study. First, when using ICD9 coding, there is always a question of inaccurate documentation. Furthermore, the racial and ethnic identifiers are based on self-report or identification by hospital administration. We lacked full race and ethnicity data on 14% of our initial cohort of patients with a primary discharge diagnosis of AF. Those who were not White or Black were deemed other, making it difficult to interpret the results for this group. This signifies a lack of emphasis on the importance of racial and ethnic data in our current research practices. We also do not have data on insurance status, income bracket, and other important socioeconomic factors. For future studies, more accurate documentation is required in order to better understand the impact of race and ethnicity on cardiovascular outcomes. Lastly, this was a study of those hospitalized with AF, recognizing that AF is largely a condition that is treated in the outpatient setting. That being said, our study does shed light on potential disparities that should be further explored in the AF population as a whole.

CONCLUSION

Using a large, nationally representative administrative data set, we found several important racial and sex disparities in the care of those who are hospitalized with AF. Although Black patients are less likely to be hospitalized for AF and are younger at the time of hospitalization, they are less likely to receive cardioversions or ablation procedures and have a higher in-hospital mortality. This analysis provides an initial evaluation of potential differences in the epidemiology, treatment, and outcomes of racial minorities with AF. Going forward, it will be necessary to develop improved databases and/or focused research designed to specifically study racial and ethnic disparities in AF hospitalizations.

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AUTHOR CONTRIBUTIONS

Design and concept of study: Naderi, Rodriguez, Wang, Foody
Acquisition of data: Naderi, Foody
Data analysis and interpretation: Naderi, Wang, Foody
Manuscript draft: Naderi, Rodriguez, Wang, Foody
Statistical expertise: Naderi, Wang, Foody
Acquisition of funding: Foody
Administrative: Rodriguez
Supervision: Foody