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# Race- and sex-related differences in care for patients newly diagnosed with atrial fibrillation

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## Abstract

**BACKGROUND—**Atrial fibrillation (AF) is associated with an increased risk of stroke and death. Uniform utilization of appropriate therapies for AF may help reduce those risks.

**OBJECTIVE—**We sought to determine whether significant race and sex differences exist in the treatment of newly diagnosed AF in Medicare beneficiaries.

**METHODS—**We used administrative encounter data for Medicare beneficiaries to identify patients with newly diagnosed AF during 2010–2011. Services received after initial AF diagnosis were cataloged, including visits with a cardiologist or electrophysiolo-gist, catheter ablation procedures, and use of oral anticoagulants, rate control agents, and antiarrhythmic drugs.

**RESULTS—**Overall, 517,941 patients met study criteria, of whom 452,986 (87%) were white, 36,425 (7%) black, and 28,530 (6%) Hispanic. Male patients comprised 209,788 (41%) of the cohort. In multivariate analysis, there were statistically significant differences in the use of AF-related services by both race and sex, with white patients and male patients receiving the most care. The most notable disparities were for catheter ablation (Hispanic vs white: adjusted hazard ratio [AHR] 0.70; 95% confidence interval [CI] 0.63–0.79; $P < .001$; female vs male: AHR 0.65; 95% CI 0.63–0.68; $P < .001$) and receipt of oral anticoagulation (black vs white: AHR 0.94; 95% CI 0.92–0.95; $P < .001$; Hispanic vs white: AHR 0.94; 95% CI 0.93–0.97; $P < .001$; female vs male: AHR 0.93; 95% CI 0.93–0.94; $P < .001$).

**CONCLUSION—**Race and sex appear to have a significant effect on the health care provided to this cohort of Medicare beneficiaries diagnosed with AF. Possible explanations include racial differences in access, patient preferences, treatment bias, and unmeasured clinical characteristics.

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Appendix
Supplementary data
Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.hrthm.2015.03.031.

**Keywords**

Outcomes; Disparities; Atrial fibrillation

## Introduction

Atrial fibrillation (AF) is a highly prevalent problem in the United States, affecting about 1% of the population and about 5% of the population aged 65 years and older.[1] The deleterious health effects of AF are protean and include a marked increase in embolic stroke risk and an association with higher mortality.[2]

For patients with AF, a few therapies are available to manage patient symptoms and decrease their long-term risk of major cardiovascular events. Oral anticoagulation has been shown to significantly decrease the frequency and severity of strokes.[3] Rate- and rhythm-controlling medications may be prescribed to restore normal heart rate and sinus rhythm. In addition, catheter ablation for AF in properly chosen patients may improve outcomes—this has been demonstrated primarily in younger patients with antiarrhythmic drug refractory symptomatic paroxysmal AF.[4,5] Finally, access to specialist physicians with experience in managing AF has been correlated with improved management; for example, in one study[6] of Medicare beneficiaries, the strongest predictors that a patient with AF receives oral anticoagulation are having a primary care provider and seeing a cardiology specialist.

Previous work[7,8] has suggested that race and sex disparities affect the treatment of patients with other cardiac conditions such as chest pain and coronary ischemia. More recently, studies have documented race and sex disparities in the likelihood of receiving certain AF-related therapies, including anticoagulation[9] and cardiac ablation.[10,11] We sought to determine whether race- or sex-based inequalities exist in the overall care of patients with AF by examining the use of outpatient clinic visits to a general cardiologist or cardiac electrophysiologist, catheter ablation procedures, antiarrhythmic and rate-controlling medications, and oral anticoagulation in Medicare beneficiaries with new diagnoses of AF.

## Methods

Data sources included the Centers for Medicare and Medicaid (CMS) Beneficiary Summary File Base and Chronic Conditions segments, Inpatient (Part A) and Carrier (Part B) Standard Analytic Files for 2009–2012, and CMS Pharmacy (Part D) Drug Events data for 2010–2012. Patient information in the data sources was de-identified. Patients were included in the study if they met the CMS chronic condition criteria for AF during 2010–2011 (defined as 1 inpatient or 2 outpatient encounters within 12 months with International Classification of Diseases, 9th Revision, Clinical Modification diagnosis code 427.31), with the first AF-related encounter occurring on or after January 1, 2010. Patients were excluded if they were younger than 66 years at the time of diagnosis (to ensure at least 12 months of Medicare eligibility before diagnosis), were enrolled in a Medicare managed care during the observation period, or were not enrolled in Medicare Part D during the month of diagnosis. Overall 536,794 patients met these criteria: 517,941 patients who were non-Hispanic white, non-Hispanic black, or Hispanic were retained for analysis. The mean duration of follow-up per patient was 640 days.

Patient sex, race, and ethnicity were determined from the Beneficiary Summary File. Race and ethnicity were defined using the Research Triangle Institute Race Code, which is an enhanced race/ethnicity designation based on first and last name algorithms that has an excellent agreement with self-reported race (κ≥0.80 for Hispanic beneficiaries and κ≥0.90 for black beneficiaries).[12]

We identified the use of 6 health services commonly used in the management of AF on the basis of Current Procedural Terminology (CPT) code and generic drug ID. Specific services included (1) visits with a general cardiologist after initial AF diagnosis (as determined by specialty taxonomy codes in the CMS National Provider Identifier physician directory); (2) visits with an electrophysiologist after initial AF diagnosis; (3) receipt of ablation (as determined by CPT code 93651); (4) receipt of rate-controlling medication (including metoprolol, atenolol, carvedilol, propranolol, vera-pamil, diltiazem, and digoxin); (5) receipt of rhythm-controlling medication (including amiodarone, sotalol, prop-afenone, flecainide, quinidine, dofetilide, and dronedarone); and (6) receipt of an anticoagulant medication (including warfarin and dabigatran). For each patient, the date of the first occurrence of each type of service or drug dispensation after initial AF diagnosis was identified. Dates of death were identified on the Beneficiary Summary File.

Preexisting patient characteristics were identified from inpatient and outpatient claims during the 12 months before the first AF diagnosis date. Comorbid conditions were defined using algorithms originally developed by Elixhauser et al.[13,14] Additional conditions relevant to AF were identi-fied. Indicator variables were generated for dual enrollment in Medicaid (as a measure of socioeconomic status) and for each patient's state of residence (to allow for capture of regional variations in care). An additional indicator variable was created to flag whether the initial diagnosis of AF was made during an inpatient encounter.

## Statistical analysis

First, characteristics of patients as of the date of first AF diagnosis were compared by race and by sex. Categorical variables (eg, presence of hypertension) were compared using the $\chi^2$statistic, while continuous or interval variables (eg, age) were compared using analysis of variance. Subsequently, we created for each patient a longitudinal record that included the date of first AF diagnosis, preexisting patient characteristics and comorbidities, and number of days to first cardiology clinic visit, electrophysiology clinic visit, catheter ablation, rate-controlling medication, rhythm-controlling medication, oral anticoagulant, and death. Cox regression models were used to evaluate the relative hazard of each service type by race and sex. Censoring events included death and the end of observation period. Initial models included race/ethnicity indicators only, while subsequent models controlled for the patient demographic and comorbid conditions listed in Table 1 by using a statistical criterion of $P < .05$ (in univariate analysis) to identify variables eligible for inclusion in multivariable models. A list of the variables included in the final models is provided in Online Supplemental Table 1. Additional models also evaluated the interaction between race and sex, which was not statistically significant (and not reported here).

A test of the proportional hazards assumption demonstrated a significant interaction between time and race as well as between time and sex. We therefore estimated included time-dependent covariates in models to estimate the relative likelihood of each service within 45 days of the initial AF diagnosis and more than 45 days after AF diagnosis (45 days was used as the cut point after inspection of the log-negative log curves suggested that, for most end points, relative patterns of care by race and sex tended to shift at approximately 45 days).

## Results

### Baseline characteristics

Overall, 452,986 patients (87%) were white, 36,425 black (7%), and 28,530 Hispanic (6%); 308,153 patients (59%) were female patients (Table 1). Compared to white patients, black patients were significantly more likely to have several key comorbid conditions. While all differences in the prevalence in comorbid conditions were statistically signifi-cant (due to the large sample size), differences were notable for congestive heart failure, hypertension, diabetes mellitus, cerebrovascular disease, and chronic kidney disease. Results were similar for Hispanic patients, although the differences tended to be smaller. White patients also had a lower mean $CHADS_2$ stroke risk score as compared with blacks and Hispanics (2.45 vs 3.04 and 2.94, respectively). There were fewer notable differences between male and female patients, although female patients had a somewhat higher mean $CHADS_2$ stroke risk score than did male patients (2.62 vs 2.38, respectively).

### Association between race and sex and AF-related care

Over a mean follow-up of 640 days, there were 443,042 patients who visited a general cardiologist, 107,772 patients who visited an electrophysiologist, 7,583 who underwent cardiac ablation, 240,935 who received oral anticoagulation, 371,017 who received a rate-controlling medication, and 127,694 who received an antiarrhythmic drug. Table 2 lists the unadjusted rates of initiating each type of service or drug therapy within 90 days of the initial AF diagnosis.

Hispanics were less likely than blacks or whites to have an outpatient clinic visit with an electrophysiology specialist. Both blacks and Hispanics were less likely than whites to receive oral anticoagulation, antiarrhythmic medication, or catheter ablation for AF. Compared with male patients, female patients were less likely to have an outpatient clinic visit with an electrophysiology specialist, oral anticoagulation, or catheter ablation for AF.

Table 3 lists the relative hazard of each type of service for blacks and Hispanics (relative to white patients) and for female patients (relative to male patients) both before and after multivariable adjustment over the entire follow-up period. In adjusted analyses, there was no difference between black and white patients in the likelihood of catheter ablation or visiting a general cardiologist. Black patients had a significantly lower likelihood of rate control, rhythm control, and oral anticoagulant medication than whites. Hispanics were less likely than whites to receive rhythm-controlling medications and catheter ablation. In particular, the relative hazard of catheter ablation for Hispanics was low as compared to whites (adjusted hazard ratio 0.70; 95% confidence interval 0.63–0.79; $P < .001$). Hispanics were more likely to visit a general cardiologist and receive rate-controlling medications. Differences in the use of oral anticoagulation by race were statistically significant, with blacks and Hispanics being less likely to receive these agents than whites.

Compared with male patients, female patients were significantly less likely to visit an electrophysiologist, undergo catheter ablation, or receive oral anticoagulation in risk-adjusted analyses. The adjusted relative hazard of catheter ablation was especially low, at 0.65 (95% con-fidence interval 0.63–0.68; $P < .001$). However, compared with male patients, female patients were more likely to receive rate- or rhythm-controlling medications.

Kaplan-Meier curves are presented in Online Supplemental Figures 1 and 2.

In analyses that incorporated time-dependent covariates, most differences in the relative hazard by race and sex before and after 45 days from the AF diagnosis date were relatively small, albeit statistically significant (Online Supplemental Table 2). Differences in the relative hazard by race before and after 45 days were particularly noticeable for the use of ablation and the use of general cardiology visits. While there was no difference in the likelihood of ablation for black patients relative to white patients through the entire follow-up period, the timing of ablation differed significantly by race. Black patients were significantly more likely than white patients to undergo ablation within 45 days of the initial AF diagnosis and significantly less likely to undergo ablation 45 days or more after diagnosis. For Hispanics, the lower use of ablation was attributed entirely to the relatively lower use 45 days or more after AF diagnosis. The lower use of rate control or rhythm control in black patients compared to whites occurs primarily in the period within 45 days of AF diagnosis, with smaller differences in the use of these medications after 45 days.

We performed sensitivity analyses to assess the robustness of our findings by looking at subsets of patients with potentially different access to subspecialty care: these groups included persons initially diagnosed with AF during an inpatient stay, persons diagnosed with AF as an outpatient, and persons who saw an electrophysiologist within 90 days of their AF diagnosis. The results of these sensitivity analyses are shown in the Online Supplemental Table 3. The results of these sensitivity analyses did not vary significantly from those of the main analysis. Specifically, anticoagulant use remained lower in minorities and female patients and ablation use remained lower in Hispanics and female patients regardless of the setting of the original AF diagnosis or whether the patient saw an electrophysiologist within 90 days of AF diagnosis. Differences in oral anticoagulant use were slightly attenuated in analyses examining patients who saw an electrophysiologist within 90 days of AF diagnosis and among patients diagnosed with AF as an inpatient. Similarly, results with time-dependent covariates for the period of time within 45 days of AF diagnosis and 45 days or more after AF diagnosis for the patient subsets mimicked findings from the analysis of all patients (not shown).

## Discussion

In our large cohort of Medicare beneficiaries diagnosed with AF, significant race- and sex-based differences in the patterns of treatment and care of AF were seen. Most of these differences remained significant after controlling for patient-level confounders. In particular, sizable differences were noted in the use of catheter ablation, with Hispanics and women being substantially less likely to undergo ablation compared to whites and male patients. While black and white patients were equally likely to undergo ablation, black patients tended to receive ablation procedures sooner after diagnosis. Differences in the use of other services were less striking, although the findings were statistically significant within a compressed follow-up time frame.

Our findings expand on the existing literature describing differences in cardiovascular care between sex and race, with a focus on the care of AF. The advantages of the use of a Medicare database include the large size of the cohort, national representation, and the ability to capture all inpatient and outpatient services. In addition, we identify patients at the time of their diagnosis of AF, which allows for an assessment of the initial patterns of care in the entire cohort.

Our findings are consistent with a body of literature that documents sex and race disparity in the dispensation of health care in the United States. Within the field of cardiovascular medicine, Feldman et al[15] have shown that women with congestive heart failure are less likely to receive specialty heart failure care than do men. In both the inpatient and outpatient settings, women with coronary artery disease receive less aggressive care than do their male counterparts.[16,17] In patients with systolic heart failure in the United States, blacks have been shown to be less likely to receive appropriate cardiac resynchronization therapy.[18] These disparities are found even in the arena of preventive care, where lipid-lowering agents are prescribed less for women with a high risk of developing cardiovascular disease than they are for their male counterparts.[19] In patients hospitalized with AF, Naderi et al[20] describe racial disparities in the receipt of inhospital AF-related therapies.

Although all patients in this cohort had the same basic insurance (Medicare) and had already been diagnosed with AF, there are several potential reasons behind the differences that we observed. Factors such as socioeconomic status and supplemental insurance may play a role in determining any given patient's access to care. While we were able to control for dual enrollment in Medicaid as ascertained from the Medicare Beneficiary Summary File, we were unable to determine whether patient had supplemental insurance outside of Medicare. Communication style may also interfere with access to specialty care. For example, Hispanics face possible language barriers[21] and women may be less likely to voice questions or concerns regarding their condition.[22] Furthermore, sex- and race-based differences in preference regarding medical care have been well documented and may be playing a role in driving our findings.[23–25]

Unmeasured clinical and demographic characteristics may also be contributing to the observed differences. In numerous reports,[26–29] socioeconomic status has been associated with both race and access to care and therefore represents an unmeasured confounder in our analysis. We speculated that the race and sex differences in the use of specific services may have resulted from differences in access to specialty care, particularly electrophysiology. However, in the sensitivity analysis that included only patients who saw an electrophysiologist within 90 days of their AF diagnosis, differences in care by race and sex remained. It is also interesting to note that female patients received more rate- and rhythm-controlling medications than do male patients, but had significantly lower likelihood of undergoing catheter ablation. It is possible that male patients prefer a more aggressive treatment approach that includes catheter ablation as compared with female patients. Lastly, bias (whether intentional or inadvertent) on the part of the treating physician must be considered as a potential source of the observed differences. This factor almost certainly plays a role in the differences in care documented in numerous studies; however, the impact of physician bias remains difficult to quantify.

The disparities we have found in AF-related care may have significant implications on patient outcomes. While the provision of oral anticoagulation has been proven to be effective in reducing the incidence of thromboembolic stroke in patients with AF, less than half of patients with AF and moderate to high stroke risk are prescribed appropriate antithrombotic therapy.[30] In selected populations, catheter ablation of AF has been shown to improve quality of life[5,31] and might play an important therapeutic role. Conversely, it may be that some proportion of the increased service utilization seen in whites and men may represent wasted care; a recent study showed that white men were the group most likely to undergo inappropriate percutaneous coronary intervention.[32] Future work will be needed to determine to what degree these disparities represent lack of equitable access to valuable care vs less inappropriate care in minorities and women.

## Study limitations

The main limitations of this study include the use of administrative observational data and the relatively short period of follow-up available (mean follow-up of 640 days). First, identification of initial AF diagnoses in administrative data is challenging. Jensen et al[33] identified 16 studies that validated algorithms to identify AF from electronic health data, including data from Medicare. Depending on the algorithm and data source, positive predictive values ranged from 70% to 96% and sensitivity from 57% to 95%. Because patients must have more than 1 AF-related encounter to meet the CMS definition of *chronic AF*, we expect that our approach has good sensitivity and excellent specificity on the basis of similar previous studies.[34,35] Importantly, the CMS definition of chronic AF does not inform the characteristics of the disease state with regard to whether AF is persistent or paroxysmal. Second, administrative data do not include potentially important prognostic indicators, such as information from diagnostic imaging, which may drive treatment decisions. This is especially important if the differences in treatment patterns we observe by race or sex are due to systematic unmeasured differences in patient severity of illness. Third, our identification of services used also depends on the accuracy of billing data. For example, we used a single CPT code (93651) to identify patients undergoing AF ablation. This is, however, consistent with the methodology used in previous studies of AF ablation to identify such patients among Medicare beneficiaries. [36,37] Moreover, we see no reason that the accuracy of codes used to identify specific services received would vary by race or sex.

Finally, although we make comparisons within our cohort regarding rates of catheter ablation in patients newly diagnosed with AF, it should be noted that not all patients would be considered good candidates for atrial ablation. Per the 2011 American College of Cardiology/American Heart Association/Heart Rhythm Society guidelines (the most relevant set of guidelines for the timeframe studied),[38] catheter ablation is a class IIA indication as a first-line therapy in a select group of patients (those with symptomatic persistent AF or those with symptomatic paroxysmal AF in those with little or no left atrial enlargement). Furthermore, it should be noted that the studies that showed benefit with catheter ablation of paroxysmal AF included significantly younger cohorts than ours.

## Conclusion

As the prevalence of AF steadily rises, the appropriate management of this chronic disease becomes increasingly important. The severe adverse long-term sequelae of AF—stroke, heart failure, and increased mortality—suggest that specialist care for this dysrhythmia is warranted. This is borne out by published findings that specialist referral in patients with AF leads to higher rates of prescription of appropriate anticoagulant therapy,[6] which has been shown to be a highly cost-effective treatment in improving outcomes.[37]

Moving forward, it will be important to identify patients with AF and provide them with a consistent standard of care, regardless of their race or sex. The cornerstones of the care of such patients are adequate symptom control, through medical management or catheter ablation, and anticoagulation for the prevention of stroke. Identifying patterns of disparity and barriers to care at the regional and local level may help to guide community-based interventions. Strategies to educate patients, change patterns of referral, and improve access to specialist care for women and minorities with AF may help to improve quality of life and cardiovascular outcomes in those patients.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## ABBREVIATIONS

| | |
|---|---|
| **AF** | atrial fibrillation |
| **CMS** | Centers for Medicare and Medicaid |
| **CPT** | Current Procedural Terminology |

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## CLINICAL PERSPECTIVES

Our article describes patterns of care, based on race and sex, in elderly patients with newly diagnosed atrial fibrillation. Our use of Medicare claims data gave us the unique ability to catalog outpatient visit types, medication therapies, and ablation procedures in a large patient cohort. We feel that these data help alert providers to some of the biases that may be present in the delivery of health care to patients with atrial fibrillation in the United States. This, in turn, can help to foster the development of programs at the community and national levels to help standardize and improve the care of patients with this dysrhythmia. Such measures are important, given the high prevalence of atrial fibrillation in our aging population.

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## Table 1

Baseline patient characteristics by race and sex

| Characteristic | Male (N = 209,788) | Female (N = 308,153) | White (N = 452,986) | Black (N = 36,425) | Hispanic (N = 28,530) |
|---|---|---|---|---|---|
| Age (y) | 77.2 ± 7.5 | 80.6 ± 8.1 | 79.2 ± 8.1 | 78.8 ± 8.3 | 79.1 ± 7.8 |
| Dual enrollment in Medicaid | 50,871 (24.2) | 111,417 (36.2) | 114,966 (25.4) | 25,543 (70.1) | 21,779 (76.3) |
| Atrial fibrillation diagnosed during inpatient care | 55,105 (26.3) | 100,260 (32.5) | 137,423 (30.3) | 10,063 (27.6) | 7,879 (27.6) |
| Comorbidities | | | | | |
| Previous myocardial infarction | 32,468 (15.5) | 37,969 (12.3) | 60,192 (13.3) | 5,825 (16.0) | 4,420 (15.5) |
| Dementia | 15,559 (7.4) | 34,943(11.3) | 40,378 (8.9) | 6,379 (17.5) | 3,745 (13.1) |
| Valvular disease | 64,343 (30.7) | 101,776 (33.0) | 143,770 (31.7) | 12,280 (33.7) | 10,069 (35.3) |
| Previous bleeding | 59,448 (28.3) | 82,282 (26.7) | 120,371 (26.6) | 12,229 (33.6) | 9,130 (32.0) |
| Cardiomyopathy | 24,993 (11.9) | 23,028 (7.5) | 38,643 (8.5) | 5,842 (16.0) | 3,536 (12.4) |
| Previous stroke | 17,221 (8.2) | 28,850 (9.4) | 37,203 (8.2) | 5,610 (15.4) | 3,258 (11.4) |
| Conduction disorder | 29,662 (14.1) | 33,649 (10.9) | 54,504 (12.0) | 5,150 (14.1) | 3,657 (12.8) |
| Cardiac valve replacement | 5,910 (2.8) | 5,888 (1.9) | 10,679 (2.4) | 532 (1.5) | 587 (2.1) |
| Congestive heart failure | 78,531 (37.4) | 118,825 (38.6) | 164,571 (36.3) | 19,349 (53.1) | 13,436 (47.1) |
| Anemia | 5,975 (2.8) | 10,383 (3.4) | 13,367 (3.0 | 1,904 (5.2) | 1,087 (3.8) |
| Coagulopathy | 19,418 (9.3) | 23,854 (7.7) | 35,693 (7.9) | 4,411 (12.1) | 3,168 (11.1) |
| Chronic obstructive pulmonary | 75,272 (35.9) | 115,739 (37.6) | 164,886 (36.4) | 14,690 (40.3) | 11,435 (40.1) |
| Cerebrovascular disease | 60,471 (28.8) | 92,525 (30.0) | 129,139 (28.5) | 13,992 (38.4) | 9,865 (34.6) |
| Depression | 23,934 (11.4) | 57,770 (18.7) | 71,012 (15.7) | 5,317 (14.6) | 5,375 (18.8) |
| Diabetes | 77,760 (37.1) | 105,812 (34.3) | 149,114 (32.9) | 18,858 (51.8) | 15,600 (54.7) |
| Fluid and electrolyte disorders | 59,426 (28.3) | 112,250 (36.4) | 143,806 (31.7) | 16,870 (46.3) | 11,000 (38.6) |
| Hypertension | 16,6415 (79.3) | 262,656 (85.2) | 370,397 (81.8) | 33,546 (92.1) | 25,128 (88.1) |
| Liver disease | 12,980 (6.2) | 17,060 (5.5) | 23,898 (5.3) | 3,147 (8.6) | 2,995 (10.5) |
| Malignancy | 47,645 (22.7) | 44,325 (14.4) | 81,376 (18.0) | 6,473 (17.8) | 4,121 (14.4) |
| Neurological disease | 28,239 (13.5) | 43,697 (14.2) | 59,056 (13.0) | 7,946 (21.8) | 4,934 (17.3) |
| Pulmonary circulation disease | 21,547 (10.3) | 41,964 (13.6) | 53,342 (11.8) | 6,638 (18.2) | 3,531 (12.4) |
| Chronic kidney disease | 46,397 (22.1) | 60,915 (19.8) | 85,902 (19.0) | 13,448 (36.9) | 7,962 (27.9) |
| Pacemaker or implantable cardioverter-defibrillator | 20,776 (9.9) | 18,477 (6.0) | 33,628 (7.4) | 3,307 (9.1) | 2,318 (8.1) |
| $CHADS_2$ score | | | | | |
| 0 | 12,571 (6.0) | 10,101 (3.3) | 21,540 (4.8) | 505 (1.4) | 627 (2.2) |
| 1 | 40,887 (19.5) | 43,728 (14.2) | 78,455 (17.3) | 3,237 (8.9) | 2,923 (10.2) |
| 2 | 63,876 (30.4) | 98,781 (32.1) | 146,284 (32.3) | 9,176 (25.2 | 7,197 (25.2) |
| 3 | 54,140 (25.8) | 87,204 (28.3 | 120,898 (26.7) | 1,1498 (31.6 | 8,948 (31.4) |
| 4 | 26,076 (12.4) | 45,487 (14.8) | 58,555 (12.9) | 7,247 (19.9) | 5,761 (20.2) |
| 5 | 8,618 (4.1) | 15,791 (5.1) | 19,582 (4.3) | 3,007 (8.3) | 1,820 (6.4) |
| 6 | 3,620 (1.7) | 7,061 (2.3) | 7,672 (1.7) | 1,755 (4.8) | 1,254 (4.4) |
| Mean $CHADS_2$ score | 2.38 ± 1.26 | 2.62 ± 1.29 | 2.45 ± 1.27 | 3.04 ± 1.30 | 2.94 ± 1.31 |

Values are presented as mean ± SD or as n (%).

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**Table 2**

Number (percentage) of patients receiving each service within 90 d of initial atrial fibrillation diagnosis

| Health Services | White (N = 452,986) | Black (N = 36,425) | Hispanic (N = 28,530) | Male (N = 209,788) | Female (N = 308,153) |
|---|---|---|---|---|---|
| Visit with an electrophysiologist | 73,091 (16.1) | 5,785 (15.9) | 4,049 (14.2) | 38,008 (18.1) | 44,917 (14.6) |
| Visit with a general cardiologist | 360,801 (79.7) | 28,160 (77.3) | 23,024 (80.7) | 169,881 (81.0) | 242,104 (78.68) |
| Catheter ablation | 3,884 (0.9) | 278 (0.8) | 164 (0.6) | 2,626 (1.3) | 1,700 (0.6) |
| Rate-controlling medication | 298,309 (65.6) | 22,325 (61.3) | 18,076 (63.4) | 132,342 (63.1) | 206,368 (67.0) |
| Rhythm-controlling medication | 96,387 (21.3) | 5527 (15.2) | 5270 (18.5) | 45,947 (21.9) | 61,237 (19.9) |
| Oral anticoagulation | 169,152 (37.3) | 11,108 (30.5) | 8,950 (31.4) | 81,464 (38.8) | 107,746 (35.0) |

## Table 3

Association between race and sex and receipt of atrial fibrillation–related health services

| Health Services | Unadjusted hazard ratio | | | | Risk-adjusted hazard ratio | | | |
|---|---|---|---|---|---|---|---|---|
| | **Hazard ratio** | **Lower confidence interval** | **Upper confidence interval** | ***P*** | **Hazard ratio** | **Lower confidence interval** | **Upper confidence interval** | ***P*** |
| Visit with an electrophysiologist | | | | | | | | |
| Black vs white | 1.04 | 1.02 | 1.06 | <.001 | 1.10 | 1.08 | 1.13 | <.001 |
| Hispanic vs white | 0.90 | 0.87 | 0.92 | <.001 | 1.01 | 0.99 | 1.04 | .36 |
| Female vs male | 0.80 | 0.79 | 0.80 | <.001 | 0.92 | 0.91 | 0.93 | <.001 |
| Visit with a general cardiologist | | | | | | | | |
| Black vs white | 0.98 | 0.96 | 0.99 | <.001 | 1.00 | 0.99 | 1.01 | .77 |
| Hispanic vs white | 1.03 | 1.02 | 1.04 | <.001 | 1.08 | 1.07 | 1.10 | <.001 |
| Female vs male | 0.94 | 0.94 | 0.95 | <.001 | 0.99 | 0.98 | 1.00 | .001 |
| Catheter ablation | | | | | | | | |
| Black vs white | 0.69 | 0.63 | 0.76 | <.001 | 1.01 | 0.91 | 1.11 | .91 |
| Hispanic vs white | 0.56 | 0.51 | 0.63 | <.001 | 0.70 | 0.63 | 0.79 | <.001 |
| Female vs male | 0.48 | 0.46 | 0.50 | <.001 | 0.65 | 0.63 | 0.68 | <.001 |
| Rate-controlling medication | | | | | | | | |
| Black vs white | 0.93 | 0.92 | 0.94 | <.001 | 0.96 | 0.95 | 0.97 | <.001 |
| Hispanic vs white | 0.97 | 0.95 | 0.98 | <.001 | 1.02 | 1.00 | 1.04 | .013 |
| Female vs male | 1.12 | 1.11 | 1.13 | <.001 | 1.16 | 1.15 | 1.17 | <.001 |
| Rhythm-controlling medication | | | | | | | | |
| Black vs white | 0.73 | 0.71 | 0.74 | <.001 | 0.79 | 0.77 | 0.81 | <.001 |
| Hispanic vs white | 0.87 | 0.85 | 0.89 | <.001 | 0.94 | 0.92 | 0.97 | <.001 |
| Female vs male | 0.90 | 0.89 | 0.91 | <.001 | 1.04 | 1.03 | 1.05 | <.001 |
| Oral anticoagulation | | | | | | | | |
| Black vs white | 0.84 | 0.83 | 0.86 | <.001 | 0.94 | 0.92 | 0.95 | <.001 |
| Hispanic vs white | 0.83 | 0.81 | 0.84 | <.001 | 0.94 | 0.93 | 0.96 | <.001 |
| Female vs male | 0.86 | 0.86 | 0.87 | <.001 | 0.93 | 0.93 | 0.94 | <.001 |