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Predictors of Regional Variations in Hospitalizations Following Emergency Department Visits for Atrial Fibrillation

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Abstract

The emergency department (ED) is often where atrial fibrillation (AF) is first detected, acutely treated and affected patients dispositioned. We used the Nationwide Emergency Department Sample (NEDS) to estimate the percentage of visits resulting in hospitalization and investigate associations between patient and hospital characteristics with hospitalization at the national and regional levels. We conducted a cross-sectional study of adults with AF listed as the primary ED diagnosis in the 2007–2009 NEDS. We performed multivariable logistic regression analyses investigating the associations between pre-specified patient and hospital characteristics with hospitalization. From 2007–2009, there were 1,320,123 weighted AF ED visits, with 69% hospitalized nationally. Mean regional hospitalization proportions were: Northeast (74%), Midwest (68%), South (74%) and West (57%). The highest odds ratios for predicting hospitalization were heart failure (3.85, 95% CI 3.66 to 4.04), chronic obstructive pulmonary disease (2.47, 95% CI 2.34 to 2.61), and coronary artery disease (1.65, 95% CI 1.58 to 1.73). After adjusting for age, privately insured (0.77, 95% CI 0.73 to 0.81) and self-pay (0.77 95% CI 0.66 to 0.90) patients had lower odds when compared to Medicare recipients, whereas Medicaid (1.21, 95% CI 1.11 to 1.32) patients tended to have higher odds. Patients living in low-income zip codes (1.18, 95% CI 1.12 to 1.25) and individuals treated at large metropolitan hospitals (1.75, 95% CI 1.59, 1.93) had higher odds. In conclusion, our analysis showed considerable regional variation in the management of ED AF patients and in associations between patient socioeconomic and hospital characteristics with ED disposition; adapting best practices from among this variation in management could reduce hospitalizations and healthcare expenses.

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CONFLICTS OF INTEREST
None

Atrial fibrillation (AF) affects between 3 and 6 million Americans with estimated national incremental healthcare costs ranging from $6 to $26 billion per year.[1–3] The emergency department (ED) is often where AF is first detected, acutely treated and affected patients dispositioned.[4,5] ED visits for AF increased by 88% between 1993 and 2004, with 64% of these visits resulting in hospitalization.[5] Understanding factors that influence hospitalization may result in more informed acute AF management. Specifically, our healthcare system may benefit from a greater knowledge of how healthcare disparities impact the significant United States (US) regional variation in hospitalizations for AF. The frequency of ED AF visits, national and regional AF hospitalizations, and ED cardioversions have not been studied following the publication of the 2006 ACC/AHA/ESC guidelines.[6] We used the Nationwide Emergency Department Sample (NEDS) to investigate age-specific ED visit rates for AF, percentage of ED visits resulting in hospitalization, as well as associations between specific patient and hospital characteristics with hospitalization at the national and regional levels.[7]

Methods

NEDS is a US administrative database maintained by the Agency for Healthcare Research and Quality as a component of the Healthcare Cost and Utilization Project. NEDS contains data from 25 – 30 million unweighted hospital-based ED visits annually representing about 20% of all US visits.[7] NEDS includes data from approximately 29 states and stratifies the data by geographic region (Northeast, Midwest, South and West), trauma center designation, urban-rural status, teaching hospital status, and ownership. The NEDS database includes weights for calculating national estimates from the 20% sample of measured ED visits. NEDS consists of 4 files: 1) a core file including demographic, diagnostic, ED charges, and disposition data; 2) a supplemental ED file with ED procedures; 3) an inpatient file with hospital procedures for those admitted; and 4) a hospital file describing the characteristics of the hospital-based ED. For each ED encounter, NEDS reports up to 15 diagnoses coded according to their respective ICD-9 codes. NEDS also classifies each ICD-9 diagnosis as a non-chronic or chronic condition based on a validated algorithm.[7,8]

We conducted a cross-sectional study of adults with AF, identified by the ICD-9 code 427.31 listed as the primary ED diagnosis from 2007–2009. We limited our analysis to the 3 years following publication of the 2006 ACC/AHA/ESC Guidelines for the Management of Patients with AF.[6] All outcomes referring to hospitalizations included visits in which the patient was admitted to the same hospital or transferred to a short-term acute care hospital. We calculated annual incidences of AFED visits from 2007–2009, percentages of AFED visits resulting in hospitalization, and the percentage of visits associated with ED or inpatient electrical cardioversions. We further stratified these incidences by US geographic region and age groups defined by the US Census.[9] We documented ED cardioversion frequencies to determine whether regional variation in hospitalization may be explained by increased frequency of ED cardioversion in the regions with lower hospitalization percentages. Electrical cardioversions performed in the ED and inpatient settings were measured using specific CPT codes 92960 and 92961 in the ED procedures section and Clinical Classifications Software code 225 in the Inpatient procedures section.

National and regional estimates of frequencies and percentages, as well as all regression analyses, accounted for the NEDS sampling design. Age-specific annual incidences of AFED visits were calculated by dividing the weighted annual number of AFED visits by July population estimates from the US Census Bureau, then expressing this quantity as ED visits per 1,000 persons. Two multivariable logistic regression analyses were used to investigate the association between a priori selected patient and hospital characteristics with hospitalization. The models evaluated associations between these independent variables, including US geographic region as an independent variable, and hospitalization from the ED

at the national level stratified by region. The Appendix Table 1 provides a detailed description of the independent variables. We chose these patient and hospital characteristics based on our prior investigations, an extensive review of the medical literature, and our clinical experience.[4,5,10–17] This study was conducted with de-identified data and was approved by the local institutional review board as non-human research. All analyses were done using the statistical programming language SAS software, Version 9.2 of the SAS System for Linux (Cary, NC).

Results

From 2007–2009, there were 376,162,043 (95% CI: 362,625,877; 389,698,208) total weighted ED visits including 1,320,123 (95% CI: 1,258776; 1,381471) weighted AFED visits. Table 1 reports the characteristics for the AFED visits overall including regional hospitalization frequencies. Characteristics stratified by census age groups are presented in Table 2. Figure 1 shows what appears to be a consistent trend in all 4 US geographic regions, with higher hospitalization percentages associated with increasing patient age. The percentage of AF patients who underwent ED electrical cardioversion nationwide during 2007–2009 was 3.5% (95% CI: 2.9, 4.1). Regional percentages of ED cardioversion were as follows: Northeast 4.3% (95% CI: 3.2, 5.5); Midwest 4.0% (95% CI: 2.5, 5.5); South 1.0% (0.7, 1.2); and West 5.6% (95% CI: 4.1, 7.1). Electrical cardioversions were most frequently performed in the youngest adults (Figure 2) and in the inpatient setting, with reported frequencies of 9.4% (95% CI: 8.8, 10) in 2007, 9.5% (95% CI: 8.8, 10.2) in 2008, and 10.1% (95% CI: 9.4, 10.8) in 2009. There was less regional variation in the performance of inpatient cardioversions (Appendix Table 2- online only).

Multivariable analyses found that the Midwest and West regions had lower odds of admission compared to the Northeast (Table 3). The strongest predictors of hospitalization were a history of heart failure, chronic obstructive pulmonary disease and coronary artery disease. After adjusting for age, privately insured and self-pay patients had lower odds of hospitalization when compared to Medicare patients, whereas Medicaid patients tended to have higher odds. Patients living in a low-income zip code and individuals treated at large metropolitan, safety net, and private investor-owned hospitals had higher odds of hospitalization. We investigated insurance status in individuals identified as low-income and found that 65% had Medicare, 6% Medicaid, 20% private insurance, 5% self-pay, and 2.5% with no charge/other insurance.

Discussion

We found that the percentage of ED AF patients hospitalized nationally remained stable between 2007–2009; however, there continues to be regional differences in AF hospitalizations. ED electrical cardioversions are infrequently performed in the US despite being an approved and routinely practiced treatment in Canada and Europe.[6,18–21] In addition to the expected differences in hospitalization due to underlying comorbidities, there were striking differences in EDAF management based on region, insurance, hospital type, and socioeconomics. These covariates may be surrogates for a patient's access to specialized healthcare resources, including whether the patient has a primary care provider or cardiologist who can monitor their AF after ED discharge. Our results provide evidence to suggest that healthcare disparities are associated with AF treatment in the US, specifically resulting in more frequent hospitalizations among patients seen at hospitals that primarily serve uninsured and underinsured patients. Better understanding of the source of these differences could generate opportunities for the delivery of more standardized treatment regimens that may provide a platform for improved care and more efficient resource utilization. Given the increasing AF prevalence and the rising number of AFED visits,

identifying strategies that will reduce the number of hospitalizations, while maintaining or improving quality of care, should be a priority.

The epidemiology and natural course for most individuals with AF is that it becomes a chronic condition requiring long-term surveillance and is not likely to be successfully treated during a 3-day hospitalization.[6,22,23] Khairallah et al reviewed US hospitalizations for primary AF between 1996 and 2001 and found a 34% increase in admissions but no significant trend toward increased or decreased inpatient mortality.[24] However, recent studies have emphasized the significance of close outpatient follow-up for patients with AF discharged from the ED citing that a lack of timely follow-up care is associated with increased 90-day mortality and repeat ED visits.[25,26] Yet, our results are consistent with the notion that the US healthcare system frequently uses expensive hospitalizations to manage AF instead of less costly outpatient care. AF management often requires a patient to take one or a combination of the following: an atrioventricular nodal blocking agent, an antiarrhythmic medication, and an oral anticoagulant. Prescribing these medications from the ED to patients lacking primary care physicians and insurance presents a number of impediments to discharge. Patients with AF need a “medical home” to monitor their AF and medication response, reevaluate their risks for stroke and bleeding, and also treat associated diseases.[6,27,28] Our analysis found that patients with private insurance, whom hospitals might have a financial interest to admit, were less likely to be hospitalized for their AF than patients with Medicare, even after adjusting for age. One plausible explanation is that patients with private insurance may have greater access to internists and cardiologists. If the ED physician can arrange a specific follow-up plan for the patient and have confidence that the patient can afford the medications and be reevaluated in a timely manner, he or she may be more likely to discharge the patient.[29]

The healthcare expenditures associated with AF hospitalization from the ED are substantial. In the 2009 NEDS data, there were an estimated 320,000 patients admitted from the ED, and the median ED and inpatient charges were nearly $20,000 more than the charges for patients discharged from the ED. These charges are likely underestimated; they do not include the charges associated with nosocomial complications that might occur from potentially preventable hospitalizations. A 15% reduction in hospitalizations would reduce inpatient charges by an estimated $1 billion dollars annually, and US hospitalizations would still be 3-fold higher than reported in Canada (16%) and Europe (29%).[7,20,21] Our results support the need for patients with AF to have a medical home to coordinate their rate or rhythm control treatments, regularly reevaluate their stroke risk, and provide urgent follow-up when they experience acute AF-related events requiring ED evaluation. Medical homes have reduced ED visits by 29%, hospitalizations by 6%, and were associated with enhanced prevention and improved chronic disease care.[28–30]

This investigation used a large national database based on administrative and charge data, and it is subject to several limitations inherent to these databases. There is the potential that our investigation underestimates the true AFED burden because patients with AF-related ED visits might have an alternative diagnosis (e.g., chest pain) listed as the primary ED diagnosis and AF listed as a supporting diagnosis. We chose to analyze only those patients with AF ICD-9 code listed as the primary diagnosis. The inclusion of patients with AF listed as a supporting diagnosis may have led to inclusion of patients with permanent AF but without an emergent AF-related condition. Charges are only a surrogate and often inflated estimate for costs and do not reflect the true “cost” of the ED visit and hospitalization. NEDS data are discharge-level records not patient-level records; thus it is impossible to account for the effect of repeat ED visits or readmissions. The prevalence of comorbidities was likely under reported given the focus of ED documentation on acute conditions. NEDS is also limited by the potential presence of residual confounders (e.g., access to primary

care, symptoms duration, anticoagulant use, and vital signs) as the administrative data lack clinical information not captured in ICD-9 codes. A large prospective cohort study would be needed to more fully investigate the effect of hospitalization on outcomes for ED patients with AF.[11]

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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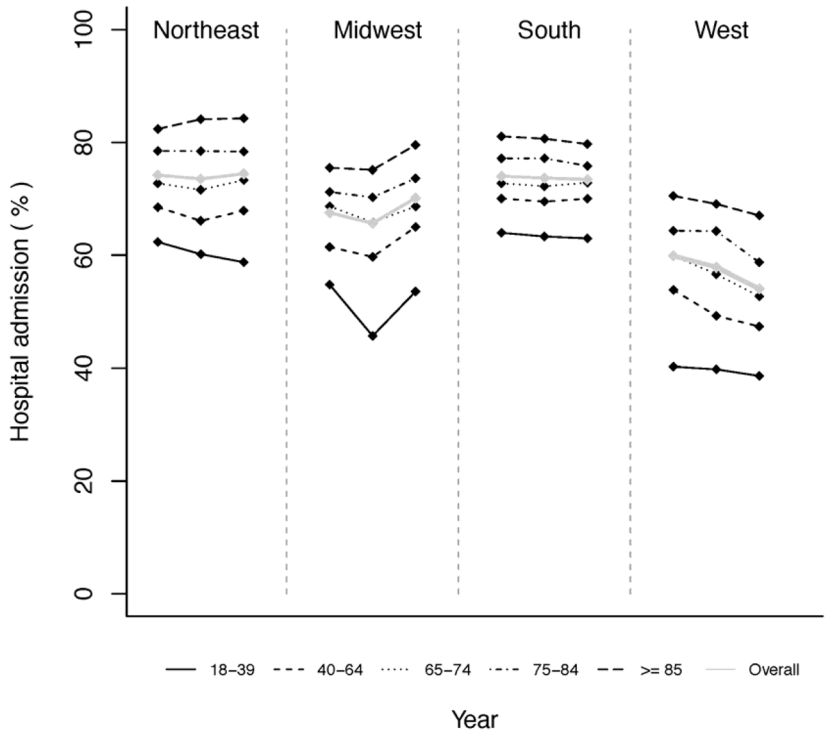

Figure 1.

Hospitalizations by region and adult census age categories

Figures are stratified by region with each dot representing a year and each line type an age group. Overall estimates for each region are also included.

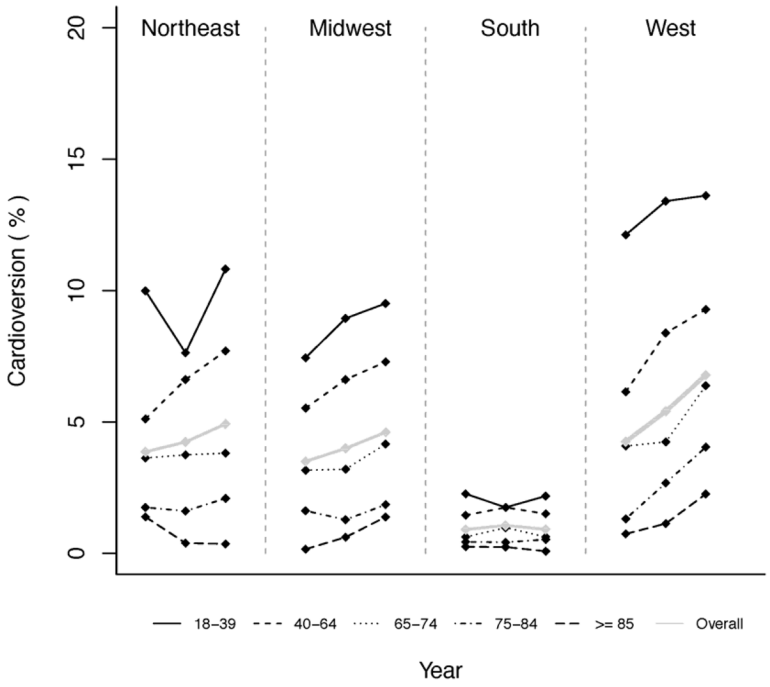

Figure 2.

ED cardioversions by adult census age category and region

Figures are stratified by region and illustrate percentages calculated from weighted frequencies. Each dot represents a year and each line type an age group, including the overall estimate for each region ignoring age.

Table 1

Characteristics For Atrial Fibrillation Emergency Department Visits

Characteristic	2007 (Non-weighted AF ED Visits n=89056)	2008 (Non-weighted AF ED Visits n=101211)	2009 (Non-weighted AF ED Visits n=102979)
Overall Weighted AF ED Visits (95% CI)	411406 (381029, 441783)	445924 (412503, 479345)	462794 (429160, 496427)
AF ED visits per 1000 person-years *	1.8% (1.6, 2.0)	1.9% (1.7, 2.2)	2.0% (1.8, 2.2)
Northeast	85834 (20.9%)	88987 (20.0%)	90547 (19.6%)
Midwest	100160 (24.4%)	103923 (23.3%)	111942 (24.2%)
South	154313 (37.5%)	166748 (37.4%)	172070 (37.2%)
West	71098 (17.3%)	86267 (19.4%)	88235 (19.1%)
Age (years) *	69.2 (68.9, 69.4)	69.4 (69.2, 69.7)	69.5 (69.3, 69.8)
Female	215406 (52.4%)	233940 (52.5%)	243443 (52.6%)
ED Disposition			
Treated and Released	119836 (29.1%)	138045 (31.0%))	141679 (30.6%)
Admitted to Same hospital	275663 (67.0%)	291822 (65.4%)	306495 (66.2%)
Transferred to Short Term hospital	12563 (3.1%)	14731 (3.3%)	13636 (3.0%)
Died in ED	152.48 (0.04%)	243.91 (0.05%)	292.95 (0.06%)
Died in Hospital	2981 (0.7%)	3092 (0.7%)	3166 (0.7%)
Regional Hospitalization % (95% CI)			
Northeast	74.2% (71.3, 77.2)	73.6% (70.4, 76.8)	74.5% (71.4, 77.6)
Midwest	67.5% (65.2, 70.0)	65.7% (63.3, 68.0)	70.2% (67.9, 72.4)
South	74.1% (72.1, 76.0)	73.7% (71.8, 75.7)	73.5% (71.7, 75.2)
West	59.9% (56.5, 63.2)	57.9% (54.4, 61.4)	54.1% (49.7, 58.5)
Length of Stay (days) *	3.7 (3.6, 3.7)	3.7 (3.7, 3.8)	3.7 (3.6, 3.7)
ED Cardioversion	3929 (2.9%)	5374 (3.5%)	6368 (4.1%)
Inpatient Cardioversion	25855 (9.4%)	27838 (9.5%)	30852 (10.1%)
Total ED Charge (USD) *	$1892(1803,1980)	$2169 (2061, 2276)	$2437 (2334, 2540)
Total Combined ED and Inpatient Charge (USD) *	$21771 (20712, 22828)	$23667 (22406, 24927)	$24752 (23635, 25869)
Weekend ED visit	103331 (25.2%)	112360 (25.2%)	115567 (25.0%)
Hypertension †	145815 (35.4%)	160797 (36.1%)	167623 (36.2%)
Diabetes †	44476 (10.8%)	50835 (11.4%)	52930 (11.4%)
Coronary Artery Disease †	60409 (14.7%)	68173 (15.3%)	68426 (14.8%)
Chronic Obstructive Pulmonary Disease †	40501 (9.8%)	33220 (7.5%)	34344 (7.4%)
Heart Failure †	70589 (17.2%)	72452 (16.3%)	82929 (17.9%)
Insurance Type % (95% CI)			
Medicare	66.2% (65.2, 37.1)	66.7% (65.8, 67.7)	66.7% (65.7, 67.7)

Characteristic	2007 (Non-weighted AF ED Visits n=89056)	2008 (Non-weighted AF ED Visits n=101211)	2009 (Non-weighted AF ED Visits n=102979)
Medicaid	4.0% (3.6, 4.3)	4.3% (3.9, 4.7)	4.7% (4.3, 5.2)
Private, including HMO	24.0% (23.2, 24.8)	23.3% (22.5, 24.2)	22.8% (22.1, 23.6)
Self-pay	3.7% (3.3, 4.0)	3.3% (3.0, 3.6)	3.5% (3.2, 3.8)
No charge	0.4% (0.2, 0.6)	0.4% (0.2, 0.5)	0.4% (0.2, 0.6)
Other	1.9% (1.6, 2.2)	2.0% (1.7, 2.3)	1.9% (1.6, 2.1)3
Low-income	98359 (24.4%)	102227 (23.5%)	105674 (23.4%)
Large Metropolitan	179112 (48.9%)	189144 (47.7%)	197803 (48.0%)
Teaching Hospital	145749 (35.4%)	149259 (33.5%)	158999 (34.4%)
Safety Net Hospital	185127 (45.0%)	213410 (47.9%)	241649 (52.2%)

Data presented as National Weighted Frequencies (Percentages of Total Annual ED AF visits) unless otherwise specified.

[*] Data reported as Mean with (95% CI)

[†] Frequencies of documented chronic disease reported as weighted frequency (%)

Table 2

Characteristics For Atrial Fibrillation Emergency Department Visits Stratified By Age Group

	Age (Years)					
Characteristic	**18–39**	**40–64**	**65–74**	**75–84**	**> 85**	**Overall**
Overall Weighted ED AF Visits	0.04% (0.04, 0.04)	0.4% (0.4, 0.4)	1.2% (1.2, 1.3)	1.5% (1.5, 1.5)	1.4% (1.4, 1.4)	0.4% (0.3, 0.4)
Female (%)	20.5% (19.6, 21.5)	36.0% (35.5, 36.5)	52.5% (51.9, 53.1)	63.6% (63.1, 64.1)	73.4% (72.8, 74.0)	52.5%(52.2, 52.8)
ED Disposition						
Discharged	44.2% (42.4, 45.9)	35.8% (34.6, 37.0)	31.2% (30.1, 32.3)	26.4% (25.4, 27.4)	21.3% (20.4, 22.2)	30.3% (29.3, 31.3)
Admitted to Same Hospital	52.3% (50.5, 54.0)	60.9% (59.7, 62.2)	64.9% (63.7, 66.2)	70.0% (68.8, 71.2)	75.4% (74.3, 76.4)	66.2% (65.1, 67.3)
Transferred to Short Term Hospital	3.0% (2.6, 3.4)	27.8% (2.5, 3.1)	3.5% (3.0, 4.0)	3.2% (2.8, 3.7)	2.9% (2.5, 3.4)	3.1% (2.7, 3.5)
Died in ED	0.02% (0, 0.04)	0.03% (0.02, 0.05)	0.04% (.02, 0.06)	0.06% (0.04, 0.07)	0.1% (0.1, 0.1)	0.05% (0.04, 0.06)
Medicare	3.7% (3.2, 4.2)	12.8% (12.4, 13.2)	83.0% (82.3, 83.8)	91.5% (90.9, 92.1)	93.6% (93.0, 94.2)	62.8% (62.1, 63.5)
Medicaid	11.6% (10.7, 12.5)	9.4% (8.9, 9.9)	1.6% (1.3, 1.8)	1.0% (0.8, 1.2)	0.6% (0.5, 0.7)	4.0% (3.8, 4.3)
Private, including HMO	62.1% (60.6, 63.6)	63.5% (62.4, 64.6)	13.6% (12.9, 14.3)	6.2% (5.7, 6.8)	4.7% (4.2, 5.2)	27.1% (26.4, 27.7)
Self-pay	17.5% (16.3, 18.6)	8.9% (8.4, 9.4)	0.9% (0.8, 1.1)	0.6% (0.5, 0.7)	0.5% (0.3, 0.6)	3.8% (3.6, 4.1)
No charge	0.9% (0.6, 1.3)	0.9% (0.6, 1.2)	0.1% (0.03, 0.1)	0.04 (0.01, 0.06)	0.03% (0.01, 0.04)	0.3% (0.2, 0.5)
Other	4.3% (3.7, 4.9)	4.5% (4.0, 4.9)	0.8% (0.7, 1.0)	0.7% (0.5, 0.8)	0.6% (0.5, 0.8)	2.0% (1.8, 2.2)
Low-income	25.1% (23.3, 26.9)	24.0% (22.5, 25.4)	24.6% (23.1, 26.2)	23.3% (21.8, 24.8)	22.5% (20.9, 24.1)	23.8% (22.3, 25.2)
Weekend ED Visit	28.1% (27.2, 28.9)	25.2% (24.9, 25.6)	25.0% (24.7, 25.5)	24.5% (24.2, 24.9)	25.1% (24.6, 25.5)	25.1% (24.9, 25.3)
Hypertension	17.2% (16.2, 18.1)	34.9% (34.3, 35.5)	40.2% (39.6, 40.9)	37.6% (36.9, 38.2)	33.5% (32.8, 34.2)	35.9% (35.4, 36.4)
Diabetes	3.6% (3.1, 4.1)	12.1% (11.7, 12.4)	13.9% (13.5, 14.3)	11.2% (10.9, 11.5)	7.5% (7.2, 7.8)	11.2% (11.0, 11.5)
Coronary Artery Disease	1.5% (1.3, 1.8)	11.0% (10.6, 11.3)	17.4% (17.0, 17.9)	18.6% (18.2, 19.0)	15.8% (15.3, 16.3)	14.9%(14.6, 15.2)
Chronic Obstructive Pulmonary Disease	0.4% (0.3, 0.5)	5.7% (5.5, 6.0)	10.0% (9.7, 10.4)	10.4% (10.1, 10.7)	8.4% (8.0, 8.7)	8.2% (8.0, 8.4)
Heart Failure	3.6% (3.2, 4.0)	12.0% (11.6, 12.4)	15.0% (14.6, 15.5)	20.3% (19.7, 20.8)	28.2% (27.5, 29.0)	17.1% (16.7, 17.5)
Large Metropolitan	53.3% (50.6, 56.1)	49.3% (46.9, 51.8)	45.5% (43.1, 47.9)	47.5% (45.1, 50.0)	49.8%(47.2, 52.3)	48.2% (45.8, 50.5)
Teaching Hospital	40.3% (37.5, 43.1)	37.8% (35.3, 40.2)	32.5% (30.0, 34.9)	32.6% (30.1, 35.1)	32.5% (29.9, 35.1)	34.4% (32.0, 36.8)
Safety Net Hospital	52.0% (48.5, 55.5)	50.5% (47.3, 53.7)	49.7% (46.5, 52.9)	46.7% (43.4, 50.0)	45.0% (41.7, 48.4)	48.5% (45.3, 51.7)
ED Electrical Cardioversion Performed	8.0% (6.5, 9.4)	5.4% (4.4, 6.4)	3.0% (2.4, 3.6)	1.6% (1.2, 1.9)	0.7% (0.4, 1.0)	3.5% (2.9, 4.1)
Inpatient Electrical Cardioversion Performed	14.2% (13.1, 15.3)	13.1% (12.5, 13.8)	10.7% (10.1, 11.3)	8.2% (7.7, 8.7)	4.6% (4.2, 4.9)	9.7% (9.2, 10.1)

Data is presented as frequencies per age group and overall with % (95% confidence intervals)

Table 3

Multivariable Analysis Investigating Association between Covariates and Hospitalization for Emergency Department Patients with Atrial Fibrillation at the National and Regional Levels

Characteristic	Region	Adjusted OR (95% CI)	P
Age	National	1.008 (1.007, 1.010)	<.0001
	Northeast	1.003 (1.00, 1.007)	0.0517
	Midwest	1.011 (1.009, 1.014)	<.0001
	South	1.006 (1.003, 1.008)	<.0001
	West	1.013 (1.010, 1.016)	<.0001
Female	National	1.064 (1.040, 1.088)	<.0001
	Northeast	1.101 (1.045, 1.160)	0.0003
	Midwest	1.035 (0.989, 1.083)	0.1419
	South	1.057 (1.022, 1.093)	0.0014
	West	1.072 (1.013, 1.133)	0.0152
United States Region	Northeast (ref)	1.00	
	Midwest	0.762 (0.655, 0.886)	0.0004
	South	0.846 (0.690, 1.036)	0.1058
	West	0.44 (0.357, 0.543)	<.0001
Heart Failure	National	3.845 (3.655, 4.017)	<.0001
	Northeast	6.154 (5.419, 6.989)	<.0001
	Midwest	3.577 (3.302, 3.874)	<.0001
	South	3.229 (2.966, 3.515)	<.0001
	West	3.882 (3.445, 4.374)	<.0001
Chronic Obstructive Pulmonary Disease	National	2.469 (2.340, 2.605)	<.0001
	Northeast	3.346 (2.916, 3.840)	<.0001
	Midwest	2.343 (2.118, 2.605)	<.0001
	South	2.285 (2.108, 2.477)	<.0001
	West	2.242 (1.959, 2.566)	<.0001
Coronary Artery Disease	National	1.651 (1.576, 1.729)	<.0001
	Northeast	2.105 (1.850, 2.396)	<.0001
	Midwest	1.492 (1.374, 1.619)	<.0001
	South	1.535 (1.420, 1.632)	<.0001
	West	1.797 (1.581, 2.043)	<.0001
Hypertension	National	1.131 (1.094, 1.205)	<.0001
	Northeast	1.437 (1.266, 1.630)	<.0001
	Midwest	1.105 (1.017, 1.200)	0.0177
	South	0.943 (0.889, 1.001)	0.0523
	West	1.263 (1.105, 1.443)	.00006
Diabetes	National	1.147 (1.104, 1.193)	<.0001
	Northeast	1.22 (1.112, 1.340)	<.0001

Characteristic	Region	Adjusted OR (95% CI)	P
	Midwest	1.147 (1.061, 1.240)	0.0006
	South	1.093 (1.030, 1.160)	0.0033
	West	1.154 (1.057, 1.261)	0.0014
Payer Status			
Medicare (ref)		1.00	
Medicaid	National	1.21 (1.110, 1.319)	<.0001
	Northeast	0.982 (0.797, 1.211)	0.8677
	Midwest	1.179 (0.986, 1.410)	0.0718
	South	1.138 (0.996, 1.281)	0.0580
	West	1.516 (1.284, 1.790)	<.0001
Private Insurance	National	0.77 (0.729, 0.812)	<.0001
	Northeast	0.599 (0.498, 0.720)	<.0001
	Midwest	0.852 (0.794, 0.914)	<.0001
	South	0.792 (0.739, 0.849)	<.0001
	West	0.849 (0.767, 0.940)	0.0016
Self pay	National	0.772 (0.659, 0.903)	0.0013
	Northeast	0.753 (0.612, 0.925)	0.0071
	Midwest	1.082 (0.937, 1.249)	0.2852
	South	0.628 (0.471, 0.839)	0.0017
	West	0.923 (0.731, 1.166)	0.5002
Low-income	National	1.182 (1.117, 1.252)	<.0001
	Northeast	1.14 (0.981, 1.325)	0.0883
	Midwest	1.201 (1.098, 1.313)	<.0001
	South	1.142 (1.056, 1.234)	0.0008
	West	1.379 (1.140, 1.666)	0.0009
Large Metropolitan	National	1.75 (1.589, 1.928)	<.0001
Hospital	Northeast	1.99 (1.570, 2.522)	<.0001
	Midwest	1.554 (1.299, 1.859)	<.0001
	South	1.785 (1.521, 2.094)	<.0001
	West	1.689 (1.352, 2.111)	<.0001
Teaching Hospital	National	1.161 (1.011, 1.333)	0.0342
	Northeast	1.236 (0.979, 1.561)	0.0752
	Midwest	1.222 (1.018, 1.466)	0.0313
	South	0.79 (0.470, 1.328)	0.3730
	West	1.047 (0.569, 1.927)	0.8835
Safety Net Hospital	National	1.219 (1.105, 1.344)	<.0001
	Northeast	0.882 (0.685, 1.137)	0.3323
	Midwest	1.107 (0.954, 1.284)	0.1808
	South	1.234 (1.047, 1.455)	0.0123

Characteristic	Region	Adjusted OR (95% CI)	P
	West	1.667 (1.410, 2.191)	<.0001
Hospital Ownership Government or Private, collapsed (ref)		1.00	
Government, non-federal, public	National	0.964 (0.807, 1.150)	0.6821
	Northeast	0.107 (0.086, 0.134)	<.0001
	Midwest	0.876 (0.684, 1.121)	0.2929
	South	0.618 (0.371, 1.030)	0.0646
	West	1.15 (0.651, 2.033)	0.6297
Private, non-profit	National	1.089 (0.898, 1.322)	0.3849
	Northeast	0.105 (0.087, 0.127)	<.0001
	Midwest	0.129 (0.112, 0.149)	<.0001
	South	0.675 (0.408, 1.116)	0.1254
	West	1.532 (0.866, 2.711)	0.1430
Private, investor-owned	National	1.514 (1.250, 1.833)	<.0001
	Northeast	0.124 (0.100, 0.153)	<.0001
	Midwest	0.15 (0.128, 0.176)	<.0001
	South	0.999 (0.601, 1.659)	0.9955
	West	1.836 (1.055, 3.195)	0.0315
Weekend ED Visit	National	0.995 (0.971, 1.019)	0.6914
	Northeast	0.971 (0.922, 1.022)	0.2602
	Midwest	1.008 (1.351, 1.839)	0.7076
	South	1.016 (1.541, 2.108)	0.3789
	West	0.97 (0.901, 1.406)	0.4306