Comparison of Baseline Characteristics and In-hospital Outcomes in Medicaid Versus Private Insurance Hospitalizations for Atrial Fibrillation

Rajkumar Doshi, MD MPH[a,1,*], Jaafar F. Al-khafaji, MD[a,1], Mihir Dave, MD[b], Mohamed Taha, MD[a], Krunalkumar Patel, MD[c], Hemant Goyal, MD[d], and Nageshwara Gullapalli, MD MPH[a]

The prevalence of atrial fibrillation (Afib) has been increasing over the past few decades. There are very few comparisons of health insurance plans available that incorporate measurement of co-morbidities and in-hospital outcomes. We sought to compare an impact of Medicaid versus private insurance (PI) on outcomes in hospitalizations with Afib. The US National Inpatient Sample database from years January 2010 to September 2015 was used to identify adult (≥18 years) Afib hospitalizations, whose payment source was either Medicaid or PI. We included propensity score-matched analysis for comparison of outcomes between the groups. In a total of 3,264,258 Afib hospitalizations, 22.9% hospitalizations were insured with Medicaid, while 77.1% had PI. Compared with PI, Medicaid beneficiaries (MB) were younger (59 vs 64 years), fewer were men (55.15% vs 63.16%), and fewer were Caucasians (52.66% vs 81.67%; all $p < 0.0001$). As suggested by Charlson co-morbidity index ≥3, more MB (40.86%) had the significantly higher burden of co-morbidities compared with PI (29.87%; $p < 0.0001$). About 83% of Afib hospitalizations had a CHA2DVASC2 score ≥2 in both the groups. After adjusting for confounders, in-hospital mortality was significantly higher (4.8% vs 4.3%, $p = 0.02$) in MB compared with PI. In MB, 55.3% hospitalizations were discharged to home and their median length of hospital stay was 5 days, whereas 61.3% hospitalizations with PI were discharged to home and their median length of stay was 4 days ($p < 0.0001$). In conclusion, this extensive study of Afib hospitalizations, Medicaid group had greater co-morbidities, marginally higher in-hospital mortality, longer length of stay, and lesser disposition to home as compared with PI group. **(Am J Cardiol 2019;123:776−781)**

Few studies have suggested that the Medicaid patients have poor inpatient clinical outcomes, extended hospital stay, and possible delay in care when compared with the privately insured patients.[1] Despite increased coverage in the government healthcare subtypes, the disparities in the types of intervention and resource utilization do exist for the people with different insurance plans.[2] Atrial fibrillation (Afib) is the most common cardiac arrhythmia and the leading cause of embolic stroke in the United States.[3] A previous study demonstrated that the frequency of the Afib ablation was much lower in the patients with government healthcare insurance plans than with private insurance.[4] Lack of appropriate management of Afib can lead to significant morbidity and mortality. Although some studies examined the impact of Afib on cost management and quality of care in Medicare patients, no study has investigated the impact of Medicaid versus private insurance on Afib. We hypothesized that the private insurance as oppose to Medicaid insurance has a significant impact on the patient mortality, treatment strategies, and length of hospitalization in the US.

Methods

This is a retrospective cohort study of adult hospitalizations with Afib across the United States from January 2010 to December 2015. This study utilized the Healthcare Cost and Utilization Project's Nationwide Inpatient Sample (NIS) database, sponsored by the Agency for Healthcare Research and Quality.[5] The NIS is the largest publicly available database which includes all-payer discharge information from a national survey of 20% of all nonfederal hospitals in the United States.[6] In the database, hospitals are stratified according to the ownership/control, bed size, teaching status, and geographic region. The NIS data are weighted to represent nearly 95% of all hospital discharges nationally. This database has been used previously to provide reliable estimates burden of Afib hospitalizations in the United States.[7] Since, the NIS contains already collected deidentified data, institutional review board approval was not required for this study.

[a]Department of Internal Medicine, University of Nevada Reno School of Medicine, Reno, Nevada; [b]Department of Public Health, Icahn School of Medicine at Mount Sinai, New York, New York; [c]Department of Cardiology, North Shore University Hospital—Northwell Health, Manhasset, New York; and [d]Division of Internal Medicine, Mercer University School of Medicine, Macon, Georgia. Manuscript received October 11, 2018; revised manuscript received and accepted November 16, 2018.

This work was performed at University of Nevada Reno School of Medicine, Reno, Nevada.[1]Both investigators contributed equally and should be considered primary investigators.

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*Corresponding author: Tel: +1 201 885 8992.

E-mail address: rdoshi@med.unr.edu (R. Doshi).

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All adult (>18 years of age) Afib hospitalizations (n = 20,479,106) were identified using International Classification of Disease-Ninth Edition-Clinical Modification (ICD-9-CM) diagnosis codes of 427.31 and 427.32.[8] Further, Afib hospitalizations with either Medicaid or private insurances were identified. Finally, a total of 3,264,258 Afib hospitalizations were included in the analysis (Figure 1).

Demographic and clinical characteristics such as age, gender, race, co-morbidities, admission type, hospital bed size, and teaching status of the hospital were collected. The race was categorized by Caucasians, African-Americans, or others. The types of admissions designated as elective and nonelective (emergent or urgent) were compared. Elixhauser co-morbidities index was utilized to categorize the patient's co-morbidities. Charlson's co-morbidity index (CCI) was used to measure the severity of co-morbid conditions in each group[9] (Supplementary Table 1). The CCI score ranges from 0 to 33, with higher scores corresponding to a higher burden of co-morbid diseases. Other co-morbid conditions included were tobacco use, history of previous percutaneous coronary intervention, previous coronary artery bypass grafting [CABG]), history of valvular heart surgery, cardiogenic shock, cardiac arrest, surgical ablation, catheter ablation, electric cardioversion. ICD-9-CM codes are provided in the Supplementary Table 2. The CHA_2D-$VASC_2$ score was calculated using variables identified by the specific ICD-9-CM codes (Supplementary Table 3). Disposition to home, the length of hospital stay (LOS), and cost of hospitalization were analyzed for both the groups. The primary end point of this study was in-hospital mortality. Other secondary end points were to compare the resource utilization between the groups, which was measured by the LOS, a disposition to home, and cost of hospitalization.

The statistical analysis was carried out using SAS 9.4 (SAS Institute Inc., Cary, North Carolina). Continuous variables were expressed as mean (± standard deviations) or median (interquartile range), according to variable distribution. Categorical variables were expressed as percentages. Intergroup and intragroup comparisons of continuous variables were analyzed using Student's *t* test or Wilcoxon rank-sum test, as appropriate. Intergroup and intragroup comparisons of categorical variables were analyzed using the chi-square test, Fisher's exact test, or McNemar's test, as appropriate. All tests were considered significant when a p value was below 0.05. The total charges for each hospital stay were converted to cost estimates using the group average all-payer in-hospital cost and charge information from the detailed reports by hospitals to the Centers for Medicare and Medicaid Services. Final cost was calculated by multiplying total cost with the cost-to-charge ratio provided by the sponsor.

This study included propensity score-matched analysis between Afib hospitalizations with Medicaid and private insurances. This is to adjust for the baseline differences which existed between the 2 groups. First, a logistic regression model was performed that included age, gender, race, CCI, CHA_2D-$VASC_2$ score, Elixhauser co-morbidities, admission type, hospital bed size, and teaching status of the hospital. After this, matching was performed using one-to-one scheme without replacement using the nearest number matching

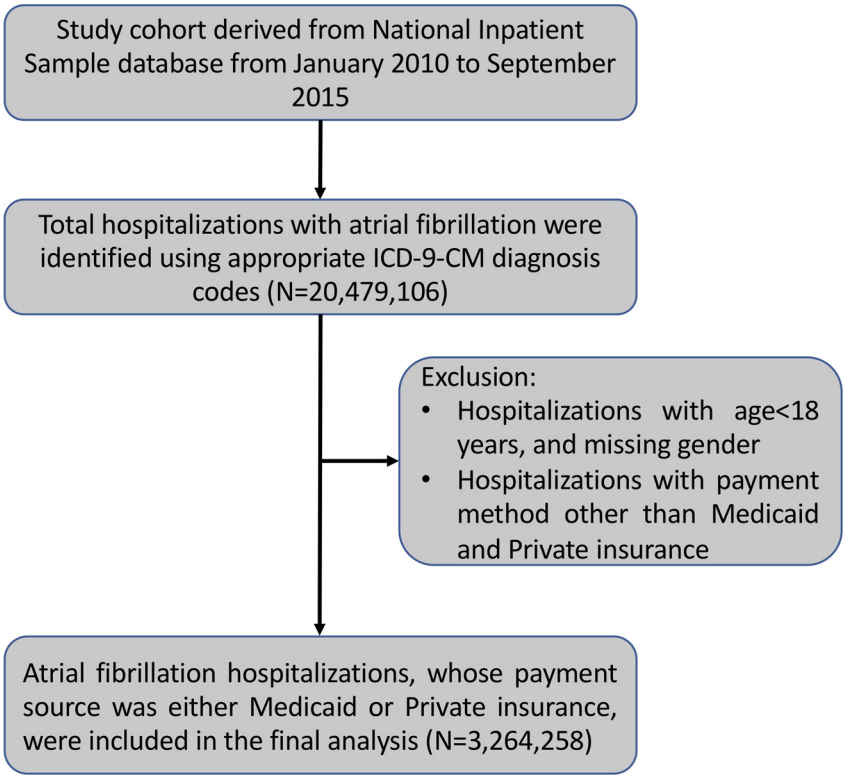

Figure 1. Patient selection flow chart.

method. After Matching, this study calculated the absolute standardized difference between the groups. Standardized difference $<10\%$ was considered acceptable in this study as it demonstrates a small difference between the 2 groups.

Results

From years January 2010 to September 2015, a total of 3,264,258 Afib hospitalizations (age ≥18 years) were identified in the NIS database. In them, 748,250 (22.9%) hospitalizations were Medicaid insured, whereas 2,516,008 (77.1%) had private insurance coverage. Table 1 shows the comparison of baseline clinical and demographic characteristics between the Medicaid and Privately insured Afib hospitalizations. Compared with Privately insured, Medicaid beneficiaries were younger (mean age: 58.7 ± 12.9 vs 64.11 ± 12.8 years, $p<0.001$), fewer were men (55.15% vs 63.16%, $p<0.0001$), and fewer were Caucasians (52.66% vs 81.67%, $p<0.001$).

The majority of hospitalizations had a significant burden of co-morbidities as suggested by CCI ≥3 with highest in Afib hospitalizations with Medicaid beneficiaries (40.86%) as compared with private insurance (29.87%;

Table 1
Baseline variables for atrial fibrillation admissions

Variables	Medicaid	Private insurance	Total	p value	Absolute standardized difference in %
Overall (unweighted)	150,751	507,216	657,967		
Overall (weighted)	748,250 (22.9%)	2,516,008 (77.1%)	3,264,258		
Mean age (years)	58.7 ± 12.9	64.1 ± 12.8	62.9 ± 13	<0.001	42.4
Gender				<0.001	16.4
Men	55.1%	63.2%	61.3%		
Women	44.9%	36.8%	38.7%		
Race				<0.001	56.9
White	52.7%	81.7%	74.9%		
Black	23.4%	8.9%	12.3%		
Others	23.9%	9.4%	12.8%		
Charlson's/Deyo co-morbidity index				<0.001	17.4
1	23.1%	25.3%	24.8%		
2	21.3%	17.5%	18.4%		
≥3	40.9%	29.9%	32.4%		
CHA_2D-$VASC_2$ score				<0.001	3.3
0	4.6%	5.3%	5.1%		
1	11.9%	12.2%	12.1%		
≥2	83.5%	82.6%	82.8%		
Obesity*	22.6%	19.9%	20.5%	<0.001	6.7
Hypertension	66.1%	65.1%	65.3%	<0.001	2
Diabetes	37.8%	30.5%	32.2%	<0.001	12.3
Chronic pulmonary disease	32.1%	21.7%	24.1%	<0.001	23.7
Peripheral vascular disease	7.7%	7.8%	7.8%	<0.001	0.4
Renal failure	20.3%	16.2%	17.1%	<0.001	10.7
Chronic liver disease	6.7%	3.0%	3.9%	<0.001	17.3
Tobacco use	34.8%	27.0%	28.8%	<0.001	16.9
Dyslipidemia	34.2%	42.8%	40.8%	<0.001	12.8
Prior percutaneous coronary intervention	6.3%	7.4%	7.1%	<0.001	4.4
Prior coronary artery bypass grafting	6.2%	7.6%	7.3%	<0.001	5.3
Prior valvular surgery	4.5%	4.0%	4.1%	<0.001	2.4
Cardiogenic shock	1.6%	1.2%	1.3%	<0.001	3
Cardiac arrest	1.8%	1.3%	1.4%	<0.001	4
Surgical ablation	0.3%	0.7%	0.6%	<0.001	4.7
Catheter ablation	1.4%	3.1%	2.7%	<0.001	11.2
Electric cardioversion	4.1%	7.1%	6.4%	<0.001	13.1
Admission type				<0.001	30.4
No- elective (emergency/urgent)	89.1%	77.9%	80.5%		
Elective	10.9%	22.1%	19.5%		
Hospital bed size				<0.001	5.8
Small	11.9%	13.7%	13.3%		
Medium	24.4%	24.7%	24.6%		
Large	63.3%	61.3%	61.7%		
Hospital teaching status				<0.001	11.1
Nonteaching	41.3%	46.2%	45.1%		
Teaching	58.2%	53.5%	54.6%		

* Obesity is defined at body mass index above 30 kg/m^2.

$p < 0.0001$). Majority of Afib hospitalizations (~83%) had $CHA_2D\text{-}VASC_2$ score ≥2 in both the groups. Afib hospitalizations in Medicaid group were more likely to have obesity (22.64 vs 19.9%, $p < 0.0001$), hypertension (66.1 vs 65.1%, $p < 0.0001$), diabetes (37.8 vs 30.54%, $p < 0.0001$), chronic pulmonary disease (32.11 vs 21.72%, $p < 0.0001$), renal failure (20.28 vs 16.15%%, $p < 0.0001$), chronic liver disease (6.73 vs 3.03%%, $p < 0.0001$), tobacco use (34.79 vs 27%, $p < 0.0001$), previous valve surgery (4.5 vs 4.01%, $p < 0.0001$), cardiogenic shock (1.57 vs 1.21%, $p < 0.0001$), and cardiac arrest (1.75 vs 1.26%, $p < 0.0001$). However, Medicaid group Afib hospitalizations were less likely to have peripheral vascular disease (7.69 vs 7.82%, $p < 0.0001$), previous percutaneous coronary intervention (6.25 vs 7.36%, $p < 0.0001$), previous CABG (6.21 vs 7.56%%, $p < 0.0001$), surgical ablation (0.33 vs 0.66%, $p < 0.0001$), catheter ablation (1.4 vs 3.06%, $p < 0.0001$), and electric cardioversion (4.1 vs 7.12%%, $p < 0.0001$). Compared with private insurance, significantly more Afib hospitalizations with Medicaid were admitted on urgent/emergent basis (89.08% vs 77.92%, $p < 0.0001$), more were admitted in large bed size hospitals (63.28% vs 61.28%, $p < 0.0001$), and more in teaching hospitals (58.24% vs 53.5%, $p < 0.0001$).

After performing propensity score matching, there was a small difference (< 10%) between all variables (Figure 2). Each group included 604,820 weighted Afib hospitalizations after performing 1:1 match (Table 2). After adjusting for potentially confounding covariates, in-hospital mortality was significantly higher (4.8 vs 4.3%, $p = 0.02$) in Medicaid beneficiaries compared with privately insured Afib hospitalizations (Table 3). In Medicaid beneficiaries, 55.3% hospitalizations were discharged to home and their median LOS was 5 days, while 61.3% hospitalizations with private insurances were discharged to home and their median LOS was 4 days ($p < 0.001$). Median cost of hospital stay was comparable between the groups ($10,034 vs $10,052, $p = 0.82$).

Discussion

In this study, hospitalizations associated with Medicaid beneficiaries were associated with a higher in-patient mortality, LOS, and requiring facility disposition other than home as compared with the private insurance. Notably, more Caucasians had private insurance whereas more African Americans were found to have Medicaid insurance in this study. Additionally, higher co-morbidity burden was noticed in hospitalizations with Medicaid as compared with private insurance. The cost of hospitalizations was similar between Medicaid and private insurances after performing propensity score matching; however, in-hospital outcomes were compromised with Medicaid hospitalizations for atrial fibrillation. Finally, the results of our analysis suggested that the healthcare management differs significantly between these 2 types of insurance beneficiaries.

Medicaid is a government-sponsored insurance plan that provides healthcare to low-income individuals and their families. The percentage of the population insured with Medicaid continues to expand every year with an increased demand. About 33 states and Washington D.C. are working on expanding Medicaid program to improve quality of care. There would be less controversy in stating that private insurance is for wealthy Americans. We emphasize an urgent need for expansion in Medicaid coverage, especially for those hospitalized for Afib.

There are several reasons as to why we observed these differences in the clinical outcomes in this study. The result of this analysis demonstrated that hospitalizations with Medicaid beneficiaries are usually younger and sicker as compared with private insurance hospitalizations. Higher disease burden represented with a higher prevalence of obesity, diabetes mellitus, hypertension, chronic obstructive pulmonary disease, liver disease, tobacco use, and cardiac diseases. This is demonstrated by higher CCI in the Medicaid group. These co-morbidities have been observed to be even higher in those states without Medicaid expansion.[10] This could explain by the socioeconomic status differences between the 2 groups, as patients with private insurance usually have higher socioeconomic status demonstrated by higher income, level of education, and accessing healthcare earlier compared with the Medicaid population. Furthermore, more women presented with Afib in the Medicaid group. Many previous studies have demonstrated worse clinical outcomes in women with Afib.[11] We performed propensity score matching to remove all potential bias as mentioned above. Even though we had less than 10% differences for all the baseline characteristics after matching, we might still have unmeasured confounders.

We postulate several reasons for possibly compromised outcomes with Medicaid insurance as compared with private insurance. First, lower reimbursement rates to healthcare provider compared with private insurance which could encourage the practitioner to select a less expensive approach.[12] Second, Medicaid population was found to receive fewer prescriptions for oral anticoagulants as compared with private insurance.[13] In our study, more patients had higher $CHA_2DS_2\text{-}VASC$ suggesting for a higher requirement for oral anticoagulants in Afib hospitalizations with Medicaid. Third, the Medicaid patients have been found to spend less time in therapeutic range as compared to private insurance.[14] Fourth, significant variation in the resource utilization including cardioversions to reverse Afib rhythm was noted in a previous study.[15] Another NIS database study pointed to the presence of disparity in the rate of revascularization for severe carotid stenosis between Medicaid and private insurance beneficiaries.[16] Taken together, Medicaid beneficiaries need additional care with an expansion of Medicaid coverage to reduced wealth-related disparities in the healthcare. Although cost was same between the groups, Medicaid actually reimbursed less as length of stay was longer along with higher in-hospital complications in the Medicaid group. This may further be affected by the proposed Medicaid cuts.[17]

Several limitations may affect our study and conclusion. First, using different codes used to retract the data from large size database may involve coding error. Second, the NIS database provides only information regarding the

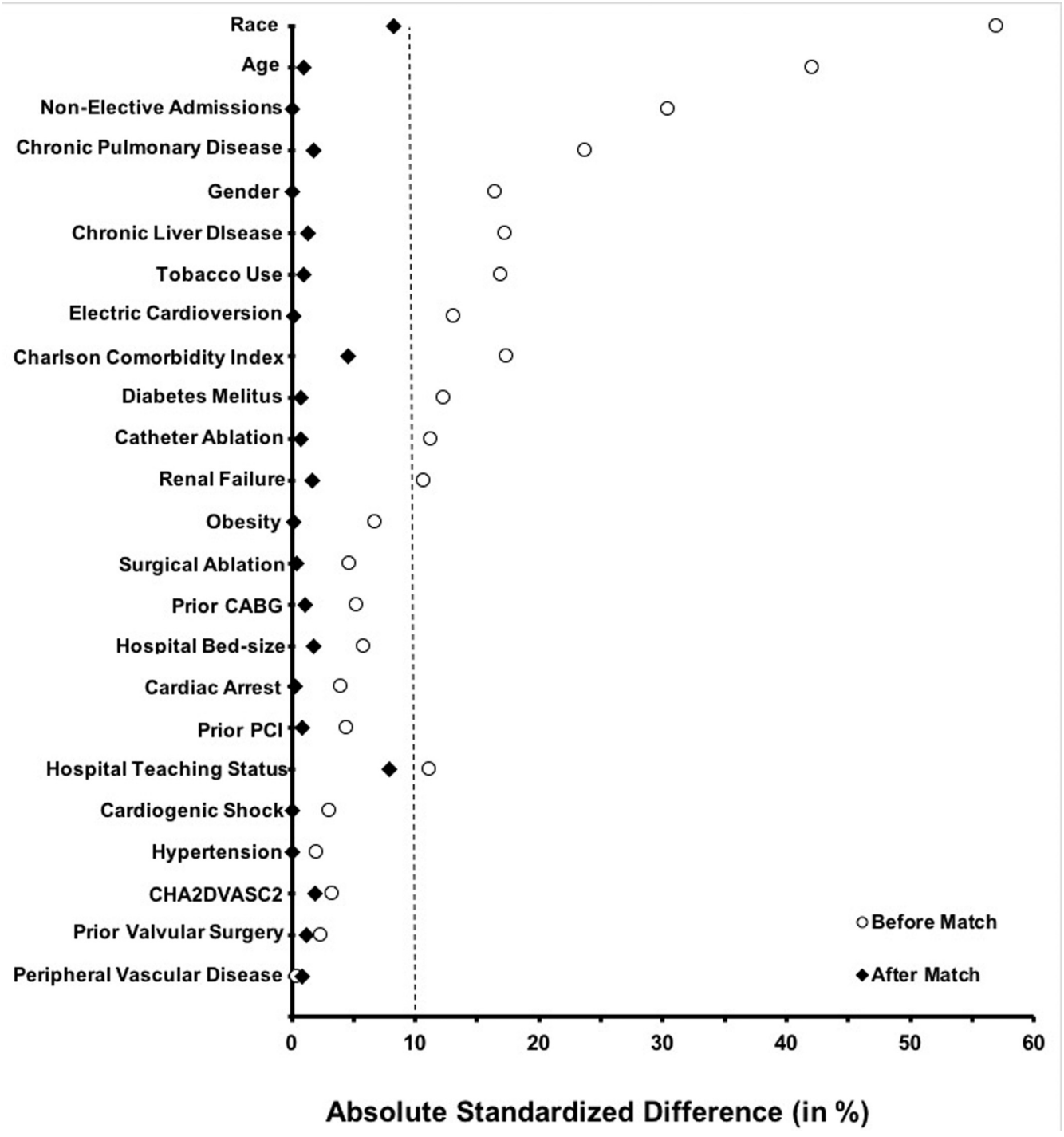

Figure 2. Pre- and postmatching absolute standardize difference between the groups
CABG = coronary artery bypass graft; PCI = percutaneous coronary intervention.

hospital stay and lack any postdischarge information. Third, limitation in generalizing the comparison between private insurance and Medicaid due to the state-specific differences in the Medicaid, in term of the resource utilization and the difference that exists between various kinds of private insurances.[18] Fourth, we do not know the type of atrial fibrillation (persistent/paroxysmal/chronic). Finally, NIS did not have information about eligibility of cardioversion for Afib. However, given the results drawn from the nation's largest dataset, the conclusion might be concerning for Medicaid beneficiaries.

In conclusion, this is the most extensive study to date which demonstrated variation in in-hospital outcomes in Afib management when comparing private versus Medicaid insurance beneficiaries. Patients with Medicaid presents with higher co-morbidities and younger age.

Table 2
Propensity score-matched variables for atrial fibrillation hospitalizations

Variables	Medicaid	Private	ASD
Overall (weighted)	604820	604820	
Mean age (years)	60.1 ± 11.9	60.2 ± 11.6	1
Gender			0.1
Men	55.8%	55.7%	
Women	44.2%	44.3%	
Race			8.3
White	50.4%	52.6%	
Black	22.0%	20.1%	
Others	27.6%	27.3%	
Charlson's/Deyo co-morbidity index			4.6
1	27.6%	29.5%	
2	25.2%	23.8%	
≥3	47.2%	46.7%	
CHA_2D-$VASC_2$ score			1.9
0	2.9%	2.8%	
1	10.1%	10.7%	
≥2	87.0%	86.5%	
Obesity	23.9%	23.8%	0.2
Hypertension	68.6%	68.5%	0.1
Diabetes	35.5%	35.1%	0.8
Chronic pulmonary disease	36.9%	36.0%	1.8
Peripheral vascular disease	9.0%	8.7%	0.9
Renal failure	23.5%	22.8%	1.7
Chronic liver disease	6.7%	6.6%	1.3
Tobacco use	35.3%	34.8%	1
Prior percutaneous coronary intervention	7.1%	6.9%	0.9
Prior coronary artery bypass grafting	7.0%	6.8%	1.1
Prior valvular surgery	4.4%	4.2%	1.2
Cardiogenic shock	1.8%	1.8%	0
Cardiac arrest	1.8%	1.7%	0.3
Surgical ablation	0.3%	0.3%	0.4
Catheter ablation	1.2%	1.1%	0.7
Electric cardioversion	4%	4.0%	0.2
Admission type			0
Nonelective (emergency/urgent)	89.3%	89.3%	
Elective	10.7%	10.7%	
Hospital bed size			1.8
Small	11.9%	12.1%	
Medium	24.6%	23.9%	
Large	63.5%	64.0%	
Hospital teaching status			7.9
Nonteaching	41.9%	44.0%	
Teaching	58.1%	56.0%	

Table 3
Propensity score-matched outcomes of atrial fibrillation hospitalizations according to Medicaid and Private insurance

Outcomes	Medicaid	Private	p value
In hospital mortality	4.8%	4.3%	0.02
Discharge to home	55.3%	61.3%	< 0.001
Length of stay, days, median (interquartile range)	5 (3-9)	4 (2-8)	< 0.001
Cost, $, median (interquartile range)	10,034 (5,576-20,457)	10,052 (5,468-20,725)	0.82

Odds ratios were adjusted for the following confounders: age, gender, race, Charlson's co-morbidity index, hospital teaching status, and hospital bed size.

They are more likely to die in-hospital or stay longer in the hospital or sent to a place other than home compared with private insurance.

Disclosures

The investigators have nothing to disclose.

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