Primary care provider payment models and adherence to anticoagulation in patients with atrial fibrillation

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What is already known about this subject

- Only 50%-60% of US patients with atrial fibrillation use anticoagulation in stroke prevention, and fewer adhere to therapy over time.
- Suboptimal anticoagulation use is associated with poor clinical outcomes.

What this study adds

- Receipt of care from a practice enrolled in a shared-savings payment model was associated with 7% higher odds of adherent use of oral anticoagulation.
- The odds of adherence to oral anticoagulation increased over time from 2015 to 2018.

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ABSTRACT

BACKGROUND: Oral anticoagulation (OAC) is recommended for the prevention of stroke in atrial fibrillation (AF). However, only 50%-60% of AF patients in the United States are treated with OAC, and 60% of them adhere to OAC therapy over time.

OBJECTIVES: To (1) compare adherent use of OAC between AF patients who received primary care from practices involved in shared-savings models and patients who

received care from practices not involved in shared savings and (2) examine the trend of adherence to OAC over time. Because OAC can save downstream medical costs associated with averted stroke events, we hypothesized that OAC adherence would be higher among patients receiving care from practices involved in shared savings.

METHODS: Using 2014-2019 claims data from a health insurer in western Pennsylvania, we identified 20,637 AF patients from 2015-2018. Patients were followed from the first

AF diagnosis (index date) for 12 months or until disenrollment. We categorized patients according to the payment model of the practice from which they received primary care: shared savings (n=8,844) and no shared savings (n=11,793). The primary outcome was adherent use of OAC therapy, which was defined as having at least 80% of the follow-up period covered with OAC. Secondary outcomes included adherent use of direct oral anticoagulants (DOACs) and adherent use of warfarin. We constructed logistic

regression models to assess the association between involvement in shared savings and adherent use of OAC, while controlling for demographics, clinical characteristics, and index year.

RESULTS: 34% of patients in the shared-savings group adhered to OAC, compared with 32.7% in the no shared-savings group ($P=0.04$). After adjustment, adherence was higher for the shared-savings group for OAC (adjusted odds ratio [aOR]=1.07, 95% CI=1.01-1.14) and warfarin (aOR=1.11, 95% CI=1.02-1.20) compared with the no shared-savings group. However, the odds of adherent use of DOACs did not statistically differ between shared savings and no shared savings (aOR=0.99, 95% CI=0.91-1.08). The odds of adherent OAC use increased over time: the aOR of adherent use of OAC was 1.21 (95% CI=1.09-1.34) for index year 2016; 1.50 (95% CI=1.36-1.67) for 2017; and 1.78 (95% CI 1.60-1.98) for 2018, all compared with 2015.

CONCLUSIONS: Receipt of primary care from a practice involved in shared savings was associated with a higher adherent use of OAC and warfarin for patients with atrial fibrillation. Furthermore, adherent use of OAC improved over time for both treatment groups. Our research demonstrates that the alignment of financial incentives between providers and insurers may improve the use of therapies with downstream cost-saving potential.

Atrial fibrillation (AF) is the most common cardiac arrhythmia and affects 34 million individuals globally.¹ It is estimated that 12 million people in the United States will have AF in 2030.² AF is associated with a 5-fold increased risk of stroke.³ Oral anticoagulation (OAC) is recommended by professional society guidelines for AF patients with moderate to high stroke risk, which is defined as having a CHA₂DS₂-VASC score of 2 or more.⁴ However, only 50%-60% of AF patients recommended for OAC treatment actually use OAC and, among users, only 60% of them adhere to the treatment over time.^{5,6} Before the approval of direct oral anticoagulants (DOACs), underuse of OAC was mostly attributed to the multiple limitations of warfarin therapy.^{7,8} However, the recent availability of DOACs has only modestly improved OAC use.⁹ The suboptimal adherence of OAC is concerning because continuous adherence to OAC is crucial for stroke prevention in AF—the missing of a single OAC dose is associated with an increased stroke risk.¹⁰ It has been estimated that increasing the optimal use of OAC by half would avert 20,000 stroke events annually and result in savings of \$1.3 million.¹¹

In 2012, experts from academia, government, industry, and professional societies convened to identify barriers to OAC use and propose solutions to this major public health problem.¹² This think tank proposed the implementation of provider payment models that align health care

system financial incentives as one of the strategies most likely to mitigate OAC underuse.^{10,13} This proposal rested on the premise that OAC can save downstream medical costs associated with averted stroke events; thus, payment models that align financial incentives between insurers and providers should incentivize the prescribing of OAC.¹¹ However, to our knowledge, no studies have formally tested this hypothesis.

To address this evidence gap, we examined data from a regional insurer in western Pennsylvania and compared OAC use between AF patients receiving primary care from practices involved in shared-savings models and patients who received care from practices not involved in shared savings. Shared savings is a payment model that offers providers savings if they reduce health care spending for a group of patients defined by specific quality measures. Because OAC can save downstream medical costs associated with averted stroke events, we hypothesized that OAC adherence would be higher among patients receiving care from practices involved in shared savings. As a secondary objective, we assessed trends in the adherent use of OAC over time.

Methods

DATA SOURCES AND STUDY POPULATION

We obtained 2014-2019 data from a regional health insurer in western Pennsylvania. We identified patients who were diagnosed with AF between January 1, 2015, and December 31, 2018. AF was defined as having 1 inpatient or 2 outpatient claims with *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnosis code 427.31 or *International Classification of Disease, Tenth Revision, Clinical Modification* (ICD-10-CM) diagnosis codes I48.0, I48.1, I48.2, and I48.91.¹⁴ The date of the first AF diagnosis in 2015-2018 was the index date. We then excluded patients who had a prescription filled for OAC in the year before the index date. To ensure availability of complete data to define covariates and the OAC washout period, we constrained sampling to patients continuously enrolled in the 12 months before the index date. Patients were followed from index date for 12 months or until death or disenrollment.

Our study sample included patients newly diagnosed with AF regardless of whether an OAC prescription was ever filled. We did not constrain for OAC initiators because the study objective was to investigate whether AF patients who received primary care from practices involved in shared-saving models are associated with higher adherent use of OAC but not OAC users. The inclusion of patients who

TABLE 1 Baseline Patient Characteristics by Treatment Group

Variables ^a	No shared-savings model (n=11,793)	Shared-savings model (n=8,844)	P value ^b
Demographics			
Age, years			
<60	2,517 (21.3)	1,638 (18.5)	<0.001
60-80	6,370 (54.2)	4,906 (55.5)	
>80	2,906 (24.6)	2,300 (26.0)	
Sex			
Male	6,435 (54.6)	4,701 (53.2)	0.044
Female	5,358 (45.4)	4,143 (46.8)	
Clinical characteristics			
Chronic kidney disease	2,591 (22.0)	2,026 (22.9)	0.110
Congestive heart failure	2,648 (22.5)	1,723 (19.5)	<0.001
Diabetes	3,746 (31.8)	2,582 (29.2)	<0.001
History of any bleeding	2,029 (17.2)	1,501 (17.0)	0.660
Hypertension	7,568 (64.3)	5,570 (63.0)	0.047
Ischemic stroke	1,282 (10.9)	944 (10.7)	0.652
Liver disease	453 (3.84)	437 (3.94)	<0.001
Myocardial infarction	587 (5.0)	466 (5.3)	0.346
Peripheral vascular disease	2,605 (22.1)	2,027 (22.9)	0.157
Substance use disorder	594 (5.0)	413 (5.7)	0.226
Thromboembolism	435 (3.7)	300 (3.4)	0.255
Valvular heart disease	526 (4.5)	297 (3.4)	<0.001
Use of antiplatelet	1,277 (10.8)	894 (10.1)	0.095
Use of NSAIDS	1,076 (9.1)	791 (8.9)	0.656

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never initiated OAC is of importance, since poor initiation and suboptimal adherence to OAC are major barriers to improved outcomes in AF.

This study was approved by the Institutional Review Board at the University of Pittsburgh as exempt because deidentified data were used in analyses.

EXPOSURE

Each study participant was assigned to a primary practice as follows: (1) patients who had selected their primary care providers (PCPs; 33% of sample) were attributed to the

reported PCP or (2) patients who had not selected a PCP, according to health insurer records (67% of sample), were matched to a practice using an algorithm that incorporated parameters including provider identifier, tax identification number, provider ZIP code, and health plan type of the claims in the previous 24 months. We categorized patients according to the payment model of the practice from which they received primary care: shared savings (n=8,844) and no shared savings (n=11,793).

Shared savings is a payment model under which providers become

eligible for savings generated by reduced spending incurred by their patients if they meet certain quality standards. At the time of this study, the shared-savings program evaluated 12 metrics based on Centers for Medicare & Medicaid Services star ratings and HEDIS scores, none of which specifically measured anticoagulation use.¹⁵ We hypothesized that practices involved in the shared-savings program would be incentivized to prescribe OAC because they would benefit from reductions in health care spending associated with averted strokes.

OUTCOMES

The primary outcome was adherent use of OAC, which was defined as having at least 80% of the follow-up period with possession of OAC. For each patient, we extracted all prescriptions for OAC, including warfarin, apixaban, dabigatran, and rivaroxaban, that were filled after the index date (date of first AF diagnosis). Using the fill dates and the days supply, we created a drug diary and calculated the number of days that patients had possession of OAC during the follow-up period. Adherent use of OAC equaled 1 for patients who had at least 80% of the follow-up period with possession of OAC, and equaled 0 otherwise. When a claim was refilled before the previous fill should have run out, we assumed that the use of the new fill started after the end of the previous fill. The OAC drug diary did not account for hospitalization days.

Secondary outcomes included adherent use of warfarin and adherent use of DOACs and were defined similarly to the primary outcome, except using prescriptions for warfarin or DOACs, respectively. This methodology has been previously used to examine adherent use of OAC.^{10,16,17} Defining medication exposure using pharmacy claims data has

TABLE 1 Baseline Patient Characteristics by Treatment Group (continued)

Variables ^a	No shared-savings model (n = 11,793)	Shared-savings model (n = 8,844)	P value ^b
Social determinants			
Area Deprivation Index score, ^c mean (SD)	107.7 (7.1)	105.4 (8.2)	<0.001
Insurance type			
Commercial	2,684 (22.8)	2,058 (23.3)	<0.001
Medicaid	1,034 (8.8)	544 (6.2)	
Medicare	8,075 (68.5)	6,242 (70.6)	
Patients who had PCP selected ^d	3,701 (31.4)	3,161 (35.8)	<0.001
Index year			
2015	6,536 (55.4)	4,050 (45.8)	<0.001
2016	2,135 (18.1)	1,486 (16.8)	
2017	1,757 (14.9)	1,618 (18.3)	
2018	1,365 (11.6)	1,690 (19.1)	

Note: Data in table are presented as n (%), unless otherwise indicated.

^aAll characteristics were evaluated at index date.

^bP value was estimated using Student's t-tests for continuous variables and chi-square tests for categorical variables.

^cThe Area Deprivation Index is a validated measure that quantifies socioeconomic factors of granular census block.²⁶

^dPatients who had selected their PCPs were attributed to the reported PCP; patients with no PCP selected according to the health insurer records were matched to a practice using an algorithm that incorporates such parameters as provider identifier, tax identification number, provider ZIP code, and health plan type of the claims in the previous 24 months.

NSAID = nonsteroidal anti-inflammatory drug; PCP = primary care provider.

care provider. Clinical characteristics included chronic kidney disease, congestive heart failure, diabetes, hypertension, ischemic stroke, liver disease, myocardial infarction, peripheral vascular disease, substance use disorder, thromboembolism, valvular heart disease, history of any bleeding, gastrointestinal bleeding, intracranial bleeding, and use of antiplatelet and nonsteroidal anti-inflammatory drugs. Index year was defined as the year patients had the first AF diagnosis. The definition of covariates has been published previously.²⁰

STATISTICAL ANALYSIS

We compared patient characteristics between shared-savings and no shared-savings groups using Student's t-tests for continuous variables and chi-square tests for categorical variables. We used multivariable logistic regression models to examine the association between receipt of care from a practice involved in shared savings and adherent use of OAC. Stepwise selection was performed for covariate selection ([Supplementary Table 1](#), available in online article). The index year was included in the model to estimate the odds of adherent use of OAC over time. The predicted probability of adherent use over time that estimated with logistic regression models was reported. P values less than 0.05 were considered statistically significant.

We performed sensitivity analyses after excluding patients who had selected a PCP. We performed a second set of sensitivity analyses among patients who did not have a diagnosis of valvular disease in the year before the index date. We performed a third set of sensitivity analyses after applying a washout period with no diagnosis of AF in the 12 months before the index date. The subcohort selected in

TABLE 2 Descriptive Statistics of Adherent Use by 2 Groups

	Outcomes	No shared-savings model (n = 11,793)	Shared-savings model (n = 8,844)	P value
Adherent use of OAC, ^a n (%)	Use of OAC	3,853 (32.7)	3,008 (34.0)	0.04
	Use of warfarin	2,214 (18.8)	1,568 (17.7)	0.06
	Use of DOAC	1,531 (13.0)	1,349 (15.3)	<0.001

^aAdherent use was defined as having ≥80% of the follow-up period with possession of OAC.

DOAC = direct oral anticoagulants; OAC = oral anticoagulation.

been reported to have sensitivity over 90%.^{18,19}

COVARIATES

Baseline covariates included demographics, social determinants, clinical

characteristics, and index year. Demographic characteristics included age group and sex. Social determinants included area deprivation index, insurance type, and whether the patient had a selected primary

FIGURE 1 Adjusted Odds Ratios for Adherent Use: Shared-Savings Group vs No Shared-Savings Group

Note: Adherent use was defined as having $\geq 80\%$ of the follow-up period with possession of OAC.

DOAC = direct oral anticoagulants; OAC = oral anticoagulation.

this third set of sensitivity analyses represented incident (newly diagnosed) AF patients.

Results

BASELINE PATIENT CHARACTERISTICS

Patients who received primary care from a practice enrolled in a shared-savings program were older and more likely to be enrolled in Medicare (Table 1). However, there were no statistically significant differences in the proportion of patients with chronic kidney disease, history of bleeding, ischemic stroke, or myocardial infarction between the 2 groups. Patients in the shared-savings group were more likely to have 2017 and 2018 (as opposed to 2015 and 2016) as index years, which reflected the increased uptake of this novel payment model over time.

ADHERENT USE OF OAC BY TREATMENT GROUP

Table 2 shows the descriptive statistics for the adherent use of OAC, warfarin, and DOACs. For the shared-savings group, 34.0% of patients adhered to OAC, compared with 32.7% in the no shared-savings group ($P=0.04$). For the shared-savings group, 15.3% of patients adhered to DOACs, compared with 13.0% in the no shared-savings group ($P<0.001$). The descriptive statistics for the proportion of follow-up time covered with OAC, warfarin, and DOACs are shown in [Supplementary Table 2](#) (available in online article).

ADJUSTED RESULTS FOR THE ASSOCIATION BETWEEN RECEIPT OF CARE FROM A PRACTICE INVOLVED IN SHARED SAVINGS AND ADHERENT USE OF OAC

Figure 1 shows the adjusted odds ratios (aOR) of adherent use of OAC, warfarin, and DOACs for patients receiving primary care from a practice involved in shared savings vs patients receiving care from practices not involved in shared savings. Adherent use of OAC (aOR=1.07, 95% CI=1.01-1.14) and adherent use of warfarin (aOR=1.11, 95% CI=1.02-1.20) were higher for the shared-savings group compared with the no shared-savings group. However, the odds of adherent use of DOACs did not statistically differ between shared savings and no shared savings (aOR=0.99, 95% CI=0.91-1.08). Results from sensitivity analyses were consistent with the primary findings ([Supplementary Table 3](#), available in online article).

TIME TRENDS IN ADHERENT USE OF OAC

After adjustment, the odds of adherent use of OAC increased over time. Specifically, the aOR of adherent use of OAC were 1.21 (95% CI=1.09-1.34) for index year 2016; 1.50 (95% CI=1.36-1.67) for index year 2017; and 1.78 (95% CI=1.60-1.98) for index year 2018, all compared with 2015 (Figure 2). The odds of adherent use of DOACs followed a similar trend, increasing over time. The odds of adherent use of warfarin, however, decreased over time (Figure 2).

Figure 3 shows the estimated probability of adhering to OAC, DOACs, and warfarin for each calendar year, based on the output from the logistic regression models. The adjusted estimated probability of adherent use of OAC increased from 28.8% in 2015 to 41.8% in 2018, after adjusting for selected covariates. The same trend was observed for adherent use of DOACs (Figure 3).

Discussion

To our knowledge, this study is the first to assess the association between shared-savings payment models and adherent use of OAC in AF patients. We found that receipt of care from a practice enrolled in a shared-savings model was associated with 7% higher odds of adherent use of OAC and 11% higher odds of adherent use of warfarin. We found a substantial improvement in adherent use of OAC over time: After adjusting for patient characteristics, the odds of adherent use of OAC were 78% higher in 2018 than 2015.

Our estimates for adherent use of OAC are in line with previous literature that estimated the rate of adherent use of OAC at around 40%.^{9,19} The improved adherent use of OAC and DOACs observed over time is also consistent with previous research.²¹⁻²³ Although our study is the first to test the

FIGURE 2 Adjusted Odds Ratios for Adherent Use by Index Year

Note: Adherent use was defined as having $\geq 80\%$ of the follow-up period with possession of OAC. DOAC = direct oral anticoagulants; OAC = oral anticoagulation.

association between a shared-savings program and adherent use of OAC, our findings are in line with a previous study that associated enrollment in the Medicare Shared Savings Program with modest increases in adherence to antihypertensive, lipid-lowering, and hypoglycemic medications.²⁴

In 2012, a panel of experts proposed that implementation of payment models that align insurer and provider financial incentives as a potential mechanism to mitigate the underuse of OAC.¹² We found a statistically significant yet modest increase in adherent use of OAC and warfarin for patients who received care from a practice enrolled in a shared-savings model. Regardless of the small magnitude of the effect, our results are important contributions to the existing literature on the effect of new provider payment models and adherence to medications with cost-saving potential, particularly because

the shared-savings model evaluated did not include any specific performance measure that directly targeted OAC use.

Adherent use of OAC could be further incentivized through the implementation of specific performance measures that capture the proportion of days covered with OAC among AF patients who are recommended for OAC treatment, in a similar way as star ratings measures of adherence to oral antidiabetics, statins, and antihypertensives are defined. The inclusion of these measures in the calculation of star ratings has been associated with improved medication adherence.²⁵

LIMITATIONS

Our study is subject to several limitations. First, claims data contain information on prescriptions filled but not on medications prescribed or on

whether patients took medications as indicated. Thus, our outcomes represent medication possession, and we were not able to distinguish between patients who were not prescribed OAC by their providers and those who were prescribed OAC but did not fill prescriptions.

Second, claims data do not capture prescriptions not covered through insurance, such as warfarin obtained through \$4 generic programs or samples obtained from physician offices. This could have resulted in an underestimation of adherent OAC use rates but should not differ between our 2 exposure groups.

Third, although we controlled for a comprehensive list of patient characteristics, our results may have still been subject to selection bias. For example, it is possible that healthy adherers were more likely to visit providers who were fast adopters of new payment models and thus more likely to be involved in a shared-savings program.

Fourth, the data source, like all claims data, did not have detailed clinical information such as body weight or international normalized ratio levels.

Fifth, we were not able to constrain for AF patients with a CHA₂DS₂-VASc score of 2 or more because of unavailability of a continuous variable for age due to data security requirements. Nevertheless, we controlled for the clinical components of CHA₂DS₂-VASc score and for categorical age in our models.

Sixth, we constructed 2 separate models to examine the associations between shared-savings models and adherence to DOAC and warfarin. Switching between therapies could have led to an underestimation of adherence rates because, when examining the outcome of DOAC use, for instance, the days covered with warfarin would not have been counted.

FIGURE 3 Estimated Probability of Adherent Use of Oral Anticoagulation by Index Year

Year	Adherent use of OAC	Adherent use of Warfarin	Adherent use of DOAC
2015	28.8 (27.7-29.9)	55.0 (54.8-55.2)	52.1 (52.0-52.3)
2016	32.8 (31.1-34.5)	54.6 (54.2-54.9)	53.5 (53.2-53.8)
2017	37.9 (36.0-39.7)	54.1 (53.8-54.4)	55.0 (54.7-55.3)
2018	41.8 (39.9-53.8)	53.6 (53.3-54.0)	56.4 (56.1-56.7)

Note: Adherent use was defined as having $\geq 80\%$ of the follow-up period with possession of OAC. Data in table is presented as probability of OAC adherent use and 95% CI.

DOAC = direct oral anticoagulants; OA = oral anticoagulation.

Switching, however, would not have affected our overall rate of adherence to OAC.

Finally, our study sample was limited to beneficiaries from 1 insurer, so our findings cannot be generalized to the entire population of AF patients, particularly, because the design of shared-savings models may differ vastly across insurers.

Conclusions

In this retrospective cohort study, we found that receipt of care from a practice involved in shared savings was associated with a modest increase in adherent use of OAC and

warfarin. Adherent use of OAC substantially improved from 2015 to 2018. Our findings suggest that provider payment models that align financial incentives may encourage the use of high-value medications with cost-saving potential.

DISCLOSURES

This project was funded by the National Heart, Lung and Blood Institute (grant number K01HL142847). Hernandez has received consulting fees from Pfizer and BMS, outside of the submitted work. The other authors have nothing to disclose.

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