Current Status and Time Trends of Oral Anticoagulation Use Among Chinese Patients With Nonvalvular Atrial Fibrillation

The Chinese Atrial Fibrillation Registry Study

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Background and Purpose—Reported rates of oral anticoagulation (OAC) use have been low among Chinese patients with atrial fibrillation (AF). With improved awareness, changing guidelines, this situation may be changing over time. We aimed to explore the current status and time trends of OAC use in Beijing.

Methods—We used the data set from the Chinese Atrial Fibrillation Registry (CAFR), a prospective, multicenter, hospital-based registry study involving 20 tertiary and 12 nontertiary hospitals in Beijing. A total of 11496 patients with AF were enrolled from 2011 to 2014.

Results—Seven thousand nine hundred seventy-seven eligible patients were included in this ancillary study. The proportions of OAC use were 36.5% (2268/6210), 28.5% (333/1168), and 21.4% (128/599) for patients with CHADS2-VASc scores ≥2, 1, and 0, respectively. Persistent AF, history of stroke/transient ischemic attack/peripheral embolism, diabetes mellitus, higher body mass index, and tertiary hospital management were factors positively associated with OAC use, whereas older age, previous bleeding, hypercholesterolemia, and established coronary artery disease were factors negatively associated with OAC use. Among patients with CHADS2 scores ≥2 and CHA2DS2-VASc scores ≥2, the proportion of OAC use increased from 31.3% to 64.5% and 30.2% to 57.7%, respectively, from 2011 to 2014. Variation in OAC use was substantial among different hospitals.

Conclusions—An improvement of OAC use among Chinese patients with AF in Beijing is observed in recent years although only 36.5% of patients with CHA2DS2-VASc score ≥2 received OAC. However, variations between different hospitals were large, suggesting that better education and awareness are needed to improve efforts for stroke prevention among AF patients.


Key Words: anticoagulants ■ atrial fibrillation ■ China ■ registries ■ risk factors ■ stroke

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia worldwide. In 2008, the estimated age-standardized AF prevalence in China was 0.65%, suggesting that at least 4 million adults had AF, and it was predicted that 5.2 million men and 3.1 million women aged >60 years will be affected by AF in China by 2050.2

AF increases the risk of stroke, and AF-related stroke is more fatal and disabling, compared with non-AF stroke.3 Oral anticoagulation (OAC) is recommended to reduce the risk of thromboembolic events in patients with AF with either a moderate or high risk of stroke.4,5 Various registry studies report that nearly half to four fifths of high-risk AF patients were taking OAC therapy in developed countries6–10; however, in Chinese patients with AF, OAC remains underused.11

During the past decade, the Chinese medical societies have made great efforts to improve stroke prevention among...
patients with AF. Several guidelines and consensus statements have been published on optimizing anticoagulant therapy for stroke prevention in patients with AF. With the launch of non–vitamin K antagonist oral anticoagulants (NOACs), more educational programs have also been conducted. However, there are limited data in China as to whether OAC rates have improved over time and which factors are associated with suboptimal use of OAC.

To address these questions, we analyzed the data from the Chinese Atrial Fibrillation Registry (CAFR) study, a real-world registry study conducted at Beijing, China, to provide contemporary data on OAC use (or nonuse) and changes over time.

Methods

CAFR is a prospective, multicenter, hospital-based registry of patients with AF. Of the 33 tertiary and 49 nontertiary hospitals receiving and tracking patients with AF in Beijing, 20 tertiary and 12 nontertiary hospitals at which the majority of patients with AF in Beijing are managed have agreed to participate in this study. Tertiary hospitals were defined as level 3 hospitals (major medical centers with at least 500 inpatient beds, providing high-level medical services to several geographic regions), and nontertiary hospitals included both level 1 (community hospitals with basic facilities) and level 2 hospitals (with at least 100 inpatient beds, providing medical care to population of at least 100,000). The CAFR study aims to recruit 20,000 patients with AF over several years and follow-up these subjects every 6 months. The main purpose of this observational study is to understand the current clinical practice patterns in China and compare different AF treatments in real-world practice. The objective of the present analysis was to provide information on anticoagulation practices in China and identify any changes over time, as well as to find opportunities for further improvement.

Study coordination and site management were coordinated by Beijing AnZhen Hospital. At each participating hospital, all patients with a diagnosis of AF who satisfied the study inclusion criteria were encouraged to participate. For those patients who provided their consent, trained cardiologists and research coordinators interviewed the patients, reviewed medical records, and abstracted relevant data, including demographic data, medical history, and treatments. All data are entered into a web-based data capture system.

Each enrolled patient will be followed up at outpatient clinic or through telephone interview. Information relating to medical therapies, emergency room visits, strokes or other embolism, hospitalizations, and deaths was collected. Since the launch of the registry in August 2011, the registry has recruited 11,977 patients.

Study Population

All patients included in the present ancillary study to CAFR were identified from CAFR database. Eligible patients were ≥18 years old, with AF documented via either ECG or Holter within the past 6 months. Exclusion criteria were as follows: patients with transient and reversible AF (caused by specific precipitating or reversible causes, including cardiothoracic surgery, hyperthyroidism, myocardial infarction, pericarditis, myocarditis, pulmonary embolism, electrocution, and binge drinking), patients having other diseases with life expectancy <1 year, patients diagnosed with rheumatic mitral stenosis or having mitral valve prostheses, and patients who underwent radio frequency catheter ablation successfully.

Success in ablation was defined as stable sinus rhythm without AF episodes lasting ≥30 s, the absence of sustained atrial flutter, or the absence of atrial tachycardia evaluated at 3 months or later after ablation. Written informed consent was provided by each patient.

Data Collection

Information on sociodemographic characteristics (age, sex, body mass index, level of education, and medical insurance coverage), medical history, including hypertension, diabetes mellitus (DM), hyperlipidemia, established coronary artery disease (CAD), any history of myocardial infarction, percutaneous coronary intervention, or coronary artery bypass grafting), vascular diseases (CAD or peripheral artery disease), previous stroke/transient ischemic attack (TIA)/peripheral thromboembolism and bleeding, history of smoking, and alcohol consumption, as well as medical use, was collected for each patient at baseline. Data collection of antithrombotic treatment was based on patient-reported warfarin usage or any newly prescribed OAC and antiplatelet medications.

Risk Stratification

The CHADS2 score was calculated for each patient by assigning 1 point each for age ≥75 years, a history of hypertension, DM, and congestive heart failure and 2 points for a history of stroke/TIA/thromboembolism. The CHA2DS2-VASc score was calculated for each patient by assigning 1 point each for age between 65 and 74 years, a history of hypertension, DM, congestive cardiac failure, vascular disease (CAD or peripheral artery disease), and female sex and 2 points each for a history of stroke/TIA/thromboembolism and age ≥75 years.

Statistical Analysis

Baseline characteristics about demographics and medical history were reported as mean±SD for continuous variables and proportions for categorical variables, compared by hospital level (nontertiary versus tertiary). The proportions of OAC use were reported according to risk stratification strata and different clinical subgroups, including age, sex, AF type, education, health insurance coverage, and hospital level. A multivariable logistic regression model was used to identify factors independently associated with OAC use. In the model, we adjusted for variables that were significant in the univariate analysis and variables with potential influence of OAC use, including age, sex, hospital level, AF type, body mass index, previous stroke, previous bleeding, established CAD, hypercholesterolemia, DM, hypertension, congestive heart failure, smoking, alcohol, education, and health insurance coverage. To assess the variations of the OAC use among different hospitals, the general linear mixed model was used by including hospital as a random effect, and the results are shown in Tables I and II in the online-only Data Supplement. P value <0.05 was considered statistically significant. All analyses were conducted using SAS software, version 9.2.

Results

Patient Characteristics

Seven thousand nine hundred seventy-seven patients were included for the analysis from the CAFR registry. Of these, 6530 were enrolled from tertiary hospitals (81.9%), and the remaining patients were enrolled from nontertiary hospitals. The mean age of the study population was 68.1±11.6 years, and male participants accounted for 57.5%. Baseline characteristics are shown in Table 1. The patients enrolled from nontertiary hospitals were older (P<0.001), more likely to be women (P<0.005), and had more comorbidities compared with those from tertiary hospitals (P<0.001). There was also a higher proportion of newly diagnosed AF from nontertiary hospitals (P<0.01). The proportions of patients with medical insurance coverage and high school education were higher among the patients from tertiary hospitals (P<0.01).

Antithrombotic Treatment According to Stroke Risk Stratification

The proportion of nonvalvular AF patients receiving OAC treatment (warfarin and NOACs) were 37.5% (1650/4397),
32.7% (764/2340), and 25.4% (315/1240) for AF patients with CHADS2  $\geq$ 2, 1, and 0, respectively. Similar proportions of OAC use were identified when the CHA2DS2-VASc schema was used (36.5%, 28.5%, and 21.4% for patients with CHA2DS2-VASc scores  $\geq$ 2, 1, and 0; Figure 1). A high proportion of aspirin use (>41%) was evident.

High proportions of patients with CHADS2 score  $\geq$ 2 or CHA2DS2-VASc score  $\geq$ 2 (51.8% and 51.9%) were using antiplatelet therapy as the only measure for thromboprophylaxis.

Factors Associated With OAC Use in Patients With AF
Factors associated with OAC use were analyzed in patients who had an absolute indication for OAC according to current guidelines (CHA2DS2-VASc score,  $\geq$ 2).

After adjusting for covariates described in baseline characteristics, the rate of OAC use were independently associated with tertiary hospital management (odds ratio [OR], 4.94; 95% confidence interval [CI], 4.00–6.09; $P<$0.001), persistent AF (OR, 2.58; 95% CI, 2.25–2.95; $P<$0.001), history of stroke/TIA/peripheral thromboembolism (OR, 1.88; 95% CI, 1.62–2.18; $P<$0.001), history of DM (OR, 1.16; 95% CI, 1.01–1.34; $P=$0.04), and body mass index  $\geq$ 28 (OR, 1.33; 95% CI, 1.13–1.57; $P<$0.001).

In contrast, patients with previous bleeding (OR, 0.72; 95% CI, 0.55–0.95; $P=0.02$), history of established CAD (OR, 0.67; 95% CI, 0.57–0.79; $P<$0.001), hypercholesterolemia (OR, 0.80; 95% CI, 0.69–0.93; $P<$0.001), and age  $\geq$ 75 years (OR, 0.81; 95% CI, 0.71–0.93; $P=0.004$) were less likely to receive OAC therapy (Table 2).

Trends of OAC Treatment
The rate of OAC use among patients with high-risk AF increased during the study period (Figure 2). The improvement in OAC usage was consistent but perhaps more evident in the latest 2 follow-up cycles (from August 2013 to August 2014, proportion of OAC usage increased from 37.9% to 64.5% in those patients with CHADS2 score  $\geq$ 2.

### Table 1. Baseline Characteristics of Study Population According to Hospital Type (Tertiary vs Nontertiary)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Overall, n/N (%)</th>
<th>Tertiary, n/N (%)</th>
<th>Nontertiary, n/N (%)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y, mean (SD)</td>
<td>68.1 (11.6)</td>
<td>67.4 (11.8)</td>
<td>70.9 (10.0)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>BMI, mean (SD)</td>
<td>25.3 (3.8)</td>
<td>25.3 (3.7)</td>
<td>25.3 (3.8)</td>
<td>0.898</td>
</tr>
<tr>
<td>Men (%)</td>
<td>4587/7977 (57.5)</td>
<td>3803/6530 (58.2)</td>
<td>784/1447 (54.2)</td>
<td>0.005</td>
</tr>
<tr>
<td>Congestive heart failure (%)</td>
<td>1921/7977 (24.1)</td>
<td>1206/5324 (18.5)</td>
<td>715/1447 (49.4)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>5581/7967 (70.1)</td>
<td>4440/6520 (68.0)</td>
<td>1141/1447 (78.9)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>DM (%)</td>
<td>2074/7977 (26.0)</td>
<td>1618/6530 (24.8)</td>
<td>456/1447 (31.5)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Previous stroke/TIA/PT (%)</td>
<td>1600/7976 (20.1)</td>
<td>1248/6529 (19.1)</td>
<td>352/1447 (24.3)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Vascular disease (%)</td>
<td>580/2468 (23.5)</td>
<td>393/2140 (18.4)</td>
<td>187/328 (75.0)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Previous bleeding (%)</td>
<td>413/7976 (5.2)</td>
<td>357/6529 (5.5)</td>
<td>56/1447 (3.9)</td>
<td>0.013</td>
</tr>
<tr>
<td>Hypercholesterolemia (%)</td>
<td>2273/7947 (28.6)</td>
<td>1808/6508 (27.8)</td>
<td>465/1439 (32.3)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Established CAD† (%)</td>
<td>1655/7975 (20.8)</td>
<td>1291/6529 (19.8)</td>
<td>364/1446 (26.2)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Smoking (%)</td>
<td>2524/7941 (31.8)</td>
<td>1958/6500 (30.1)</td>
<td>566/1441 (39.3)</td>
<td>0.031</td>
</tr>
<tr>
<td>Drinking (%)</td>
<td>2288/7934 (28.8)</td>
<td>1859/6493 (28.6)</td>
<td>429/1441 (29.8)</td>
<td>0.155</td>
</tr>
</tbody>
</table>

AF indicates atrial fibrillation; BMI, body mass index; CAD, coronary artery disease; DM, diabetes mellitus; PT, peripheral thromboembolism; and TIA, transient ischemic attack.

*Expressed as proportions and percentages, except where indicated. Denominators may be subject to missing data.
†Established CAD includes history of myocardial infarction, history of percutaneous coronary intervention, and history of coronary artery bypass grafting.
and from 38.1% to 57.7% in those with CHA₂DS₂-VASc scores ≥2). Of note, proportions of patients on OAC therapy only increased 7% to 8% in the first 4 cycles (from August 2011 to August 2013).

Variations of OAC Treatment Among Different Hospitals

Rates of OAC use varied widely among different hospitals. Among hospitals with >50 patients enrolled, the rates of OAC use varied from 9.6% to 68.4% in tertiary hospitals and from 4.0% to 28.2% among nontertiary hospitals (Figure 3A and 3B). These variations were still significant even after adjusting for the enrolled patients’ characteristics (intercept P among tertiary hospitals, 0.01; and nontertiary hospital, 0.008) (Tables I and II in the online-only Data Supplement).

Discussion

Our study provides contemporary information on the use of OAC in patients with nonvalvular AF, and its changes over time in Chinese patients. Although ≈85% of AF patients had at least 1 stroke risk factor, the rate of OAC use overall remained relatively low, especially in nontertiary hospitals. Multivariate analysis showed that tertiary hospital management, persistent AF, history of stroke/TIA/peripheral embolism, and higher body mass index were independently associated with OAC use, whereas elder age (≥75 years), previous bleeding, history of established CAD, and hypercholesterolemia were factors associated with OAC underuse. Although significant improvements in OAC treatment have been observed in high-risk patients over the study period, variations of OAC use between hospitals remained significant even after patients’ characteristics were adjusted for.

Although AF is well recognized as a major risk factor for ischemic stroke, OAC was extremely underused in previous reports from China. Studies from the China nationwide survey from January 1999 to December 2001 revealed that <10% of hospitalized patients with AF were on warfarin therapy,17,18 and among community-based patients with AF, OAC usage was even lower (2.7%).1 Moreover, antiplatelet agents have been commonly used (56%) for stroke prevention among Chinese patients with AF,18 but this approach using antiplatelet agents is neither safe nor effective for stroke prevention in patients with AF.19

Data on OAC use in developed countries are available from many previous studies. For example, the US nationwide ORBIT-AF study showed that 76% of AF outpatients received OAC (71% warfarin and 5% dabigatran), and the use of OAC was even higher (80%) among those with CHADS₂ scores ≥2.7 In the EUROPRe Observational Research Programme on Atrial Fibrillation Pilot Survey,8 80.5% of European AF patients with CHA₂DS₂-VASc scores ≥1 received OAC therapy. In the GARFIELD-AF registry, 62% of AF patients with CHADS₂ scores ≥2 received OAC therapy.9

In contrast to reports from Western countries, Chinese patients with AF have consistently been reported to receive lower rates of OAC therapy for stroke prevention. In the international RE-LY AF registry, for example, only 11.2% of AF patients with CHADS₂ scores ≥2 enrolled from China received OAC compared with 65.7% patients with the same risk score in North America subjects.10

The low usage of warfarin in China may be because of several reasons. First, the large number of patients attending outpatient clinics limits the time that clinicians have to explain about OAC treatment, its risks and benefits, and organizing education and monitoring. All these factors impair the clinicians from prescribing anticoagulants and patients to adhere to therapy. Second, the perceived risks of bleeding restrict use of OAC, especially since Asian patients are inclined to more bleeding on warfarin,20 which impairs the willingness of providers and patients to use it. Finally, the high cost of the NOACs (currently dabigatran and rivaroxaban, are approved in China) means this treatment not affordable for the great majority of patients in China.
The results of current study show that the OAC treatment in patients with AF may be improving in China, consistent with previous studies. In the quality evaluation of stroke care and treatment (ChinaQUEST) study, which registered patients with recent stroke in 2006, in-hospital OAC use was 11% among patients with nonvalvular AF. In the China National Stroke Registry II conducted from 2012 to 2013, the use of warfarin at discharge among acute ischemic stroke patients with NV AF was only 19.4%. Another registry study conducted between 2009 and 2011 reported that the rates of OAC use were 31.7% and 28.3%, respectively, among patients with CHADS2 scores or CHA2DS2-VASc scores ≥2. Our data show that further improvements have been achieved in recent years. Despite the improvement in overall OAC usage, attention should be paid to the large variation of OAC treatment among different hospitals, especially when tertiary and nontertiary hospitals are compared. There was 17-fold difference of the rate of OAC use between the hospital with the highest use compared with the hospital with the lowest use, which remained significant even after adjustment of patient characteristics. Specifically, the usage of anticoagulant therapy remained low in nontertiary hospitals. Thus, initiatives should be designed accordingly to improve the care of patients with AF in nontertiary hospitals, especially considering that the Chinese healthcare system is beginning to adapt and improve systems of care.

Several patient subgroups were suboptimally treated, including patients aged ≥75 years, as well as patients with paroxysmal AF and those with established coronary heart disease. These findings are in line with other studies reporting similar undertreated subgroups. One possible explanation may be the concerns about a higher risk of OAC-associated hemorrhage in the elderly population. However, observational studies and meta-analyses show comparable rates of major bleeding with warfarin and aspirin, whereas stroke risk is significantly reduced with warfarin in patients with AF aged >75 years. The observation that persistent AF patients

<table>
<thead>
<tr>
<th>Variables</th>
<th>n/N (%)</th>
<th>OR (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1132/3141 (36.0)</td>
<td>1.00 (0.87–1.16)</td>
<td>0.98</td>
</tr>
<tr>
<td>Male</td>
<td>1136/3069 (37.0)</td>
<td>1.00</td>
<td>0.98</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥75</td>
<td>808/2537 (31.9)</td>
<td>0.81 (0.71–0.93)</td>
<td>0.0035</td>
</tr>
<tr>
<td>&lt;75</td>
<td>1460/3673 (39.8)</td>
<td>1.00</td>
<td>0.0035</td>
</tr>
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<td>Hospital level</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Tertiary</td>
<td>2086/4917 (42.4)</td>
<td>4.94 (4.00–6.09)</td>
<td>&lt;0.0001</td>
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<td>Nontertiary</td>
<td>182/1293 (14.1)</td>
<td>1.00</td>
<td>&lt;0.0001</td>
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<td>AF type</td>
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<td>Persistent</td>
<td>1248/2678 (46.6)</td>
<td>2.58 (2.25–2.95)</td>
<td>&lt;0.0001</td>
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<td>Paroxysmal</td>
<td>884/2813 (31.4)</td>
<td>1.00</td>
<td>&lt;0.0001</td>
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<tr>
<td>BMI</td>
<td></td>
<td></td>
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<tr>
<td>≥28</td>
<td>453/1061 (42.7)</td>
<td>1.33 (1.13–1.57)</td>
<td>0.0008</td>
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<td>&lt;28</td>
<td>1614/4304 (37.5)</td>
<td>1.00</td>
<td>0.0008</td>
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<tr>
<td>Previous stroke/TIA/PT</td>
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<td></td>
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<tr>
<td>Yes</td>
<td>713/1599 (44.6)</td>
<td>1.88 (1.62–2.18)</td>
<td>&lt;0.0001</td>
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<tr>
<td>No</td>
<td>1555/4614 (33.7)</td>
<td>1.00</td>
<td>&lt;0.0001</td>
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<tr>
<td>Previous bleeding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>128/360 (35.6)</td>
<td>0.72 (0.55–0.95)</td>
<td>0.02</td>
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<td>No</td>
<td>2140/5847 (36.6)</td>
<td>1.00</td>
<td>0.02</td>
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<td>Established CAD</td>
<td></td>
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<tr>
<td>Yes</td>
<td>462/1610 (28.7)</td>
<td>0.67 (0.57–0.79)</td>
<td>&lt;0.0001</td>
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<tr>
<td>No</td>
<td>1805/4593 (39.3)</td>
<td>1.00</td>
<td>&lt;0.0001</td>
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<td>Hypercholesterolemia</td>
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<tr>
<td>Yes</td>
<td>652/1946 (33.5)</td>
<td>0.80 (0.69–0.93)</td>
<td>0.003</td>
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<tr>
<td>No</td>
<td>1610/4237 (38.0)</td>
<td>1.00</td>
<td>0.003</td>
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<tr>
<td>DM</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Yes</td>
<td>715/1986 (36.0)</td>
<td>1.16 (1.01–1.34)</td>
<td>0.04</td>
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<tr>
<td>No</td>
<td>1553/4232 (36.7)</td>
<td>1.00</td>
<td>0.04</td>
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<td>Hypertension</td>
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<tr>
<td>Yes</td>
<td>1810/5028 (36.0)</td>
<td>1.04 (0.88–1.22)</td>
<td>0.66</td>
</tr>
<tr>
<td>No</td>
<td>457/1175 (38.9)</td>
<td>1.00</td>
<td>0.66</td>
</tr>
<tr>
<td>Congestive heart failure</td>
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<td></td>
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<tr>
<td>Yes</td>
<td>566/1862 (30.4)</td>
<td>0.89 (0.75–1.05)</td>
<td>0.15</td>
</tr>
<tr>
<td>No</td>
<td>1702/4353 (39.1)</td>
<td>1.00</td>
<td>0.15</td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Yes</td>
<td>225/641 (35.1)</td>
<td>0.99 (0.77–1.28)</td>
<td>0.96</td>
</tr>
<tr>
<td>No</td>
<td>2034/5542 (36.7)</td>
<td>1.00</td>
<td>0.96</td>
</tr>
</tbody>
</table>

(Continued)
were more likely to have OAC has been seen in other studies.\textsuperscript{29,30} Although the risk of stroke in paroxysmal AF is possibly lower compared with persistent or permanent AF patients, different studies reported conflict results,\textsuperscript{31–33} and there is no evidence to recommend decision making for OAC in a patient by whether the subtype is persistent or paroxysmal AF.\textsuperscript{4,5} For
patients with established CAD, concurrent medical therapy, especially antiplatelet agents, may negatively affect the usage of warfarin. Nevertheless, among patients with stable CAD, OAC alone rather than antiplatelet or combined therapy should be used in such stable patients. Nonadherence to guideline-directed OAC use may also be influenced by many variables, including the healthcare system, physician factor, and patient-level considerations. To improve OAC treatment among patients with AF, numerous methods have included establishment of specialized anticoagulation clinics, antithrombotic education programs, anticoagulation intensity monitoring, point-of-care patient self-testing, and computerized algorithms for warfarin dose adjustment. In addition, promoting a rational appraisal of the risks and benefits of anticoagulation is essential to reduce decisional conflicts for physicians. The improvement in OAC treatment in this study is perhaps concurrent with the launching of NOACs in China, which resulted in the initiation of several measures to improve OAC use all around the country.

**Limitations**

First, all participating centers of this registry are located in Beijing, from both urban and suburban areas, and the data can only reflect the practice patterns of a relatively developed area in China and may not fully be representative of the whole country, especially rural areas. However, characteristics of patients enrolled in this study are fairly comparable with those reported in a community-based study conducted in China. In addition, the majority of the patients included in this study were recruited from high-volume tertiary centers, but it is a unique characteristic of the Chinese healthcare system that patients go directly to tertiary hospitals for specialist management, without any referral. Thus, patients in this study are broadly representative of the Beijing AF population as 20 (of 33) tertiary and 12 (of 49) nontertiary hospitals in Beijing participated the study. The participating hospitals were representative of the tertiary hospitals, where majority of patients with AF are managed. Despite this study being focused around the most developed city in China (i.e., Beijing) and including most of the main hospitals, the treatment gap remains large despite some improvements in recent years and call for interventions to increase OAC treatment in China as anticoagulation is still significantly underused for stroke prevention in AF.

Finally, NOACs were not available until 2013 in China, and these drugs are not covered by medical insurance. Only a small proportion of patients enrolled were using NOACs in this study. In spite of these limitations, the present analysis of the largest AF registry in China provides insights into the current status and time trends in OAC treatment among Chinese patients with nonvalvular AF.

In conclusion, an improvement of OAC use among Chinese patients with nonvalvular AF in Beijing is observed in recent years although only 36.5% of patients with CHA2DS2-VASc score $\geq 2$ received OAC. However, variations between different hospitals were large, suggesting that better education and awareness are needed to improve efforts for stroke prevention among patients with AF.

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**References**


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