

# Antithrombotic prophylaxis of atrial fibrillation in an Italian real-world setting: a retrospective study

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**Objectives:** The aims of this study were to assess the prevalence of diagnosed atrial fibrillation (AF), the drug use in patients with AF in terms of antithrombotic (AT) strategies used and the compliance with treatment, and to describe the characteristics of patients affected by AF in relation to treatment.

**Methods:** The data collected were provided from databases of general practitioners (GPs) of the Local Health Unit of Bologna in Italy. From January 1, 2009, to December 31, 2012, all subjects aged  $\geq 18$  years followed by the 44 GPs enrolled in the study were evaluated, and the subjects with a diagnosis of AF were included in the analysis.

**Results:** From 2009 to 2012, we identified 1,413 patients with a diagnosis of AF (2.09% of 67,517 patients of the 44 GPs). A total of 1,413 patients with a diagnosis of AF (2.09% of 67,517 patients of the 44 GPs) were enrolled in the study. During the study, 14% of the enrolled patients did not receive any prescription of ATs, 30% and 39.56% were treated only with antiplatelet (AP) agents and oral anticoagulants (OACs), respectively, and 16.28% of the patients received prescriptions for both an OAC and an AP agent; of the patients receiving prescriptions for both, only 4.17% received these therapies at the same time. Among the OAC users, the percentage of patients still on treatment with the index drug during the last 3 months of observation was 76.9%.

**Conclusion:** Our findings emphasize that in an Italian real-world setting, the burden of AF in general population from a public health point of view underscores the need for improvement in utilization of appropriate ATs in patients with known AF.

**Keywords:** atrial fibrillation, oral anticoagulant, antiplatelet agents, general practitioner, real world

## Introduction

Atrial fibrillation (AF) is the most common type of cardiac arrhythmia, occurring in 1–2% of the general population worldwide; the prevalence of AF increases steeply with age, from  $<0.5\%$  at 40–50 years to 5–15% at 80 years.<sup>1,2</sup> Men are more often affected than women.<sup>3,4</sup> In all,  $>6$  million Europeans suffer from this arrhythmia, and its prevalence is estimated to double in the next 50 years as the population ages.<sup>1</sup>

AF is often associated with increased rates of death, stroke and other thromboembolic events; hospitalization; and degraded quality of life.<sup>5</sup> Because the success of therapy depends on the individual patient's underlying level of risk, an accurate stratification of patients' level of risk is needed to select the appropriate therapeutic strategy.<sup>6</sup> Current national and international practice guidelines for the optimal management of patients with AF recommend careful consideration of individual factors and baseline comorbidities when choosing the most appropriate antithrombotic (AT)

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agent.<sup>7-9</sup> Consistently, numerous risk stratification schemes have been developed to predict the level of risk profile in patients and to manage patients accordingly.<sup>10</sup>

Oral anticoagulants (OACs), also called vitamin K antagonists (VKAs), are an effective primary preventive intervention for patients with AF at a moderate and high risk of stroke.<sup>1,11</sup> Nevertheless, these agents are associated with a number of limitations, including, when not adequately controlled, a risk of bleeding.

Antiplatelet (AP) agents have been widely used for stroke prophylaxis in patients with AF, particularly in patients with nonvalvular AF who are considered at a low risk of stroke or in patients in whom OAC therapy is contraindicated.<sup>5</sup>

A number of studies have demonstrated that maintaining the intensity of anticoagulation is crucial to achieving effective stroke prevention and for avoiding bleeding complications.<sup>12,13</sup> Some studies have examined OACs utilization in a “real-life” setting through administrative claims databases and have reported that their use is suboptimal.<sup>14-16</sup>

In view of these findings, AF management represents a considerable cost burden on health care systems, and strategies to improve the entire process of AF care should be suggested based on knowledge obtained from real-world scenarios.

The aims of this retrospective cohort study were to assess the prevalence of AF diagnoses, the drug usage in patients with AF in terms of the AT strategies used and the compliance with treatment and to describe the characteristics of patients affected by AF in relation to treatment.

## Methods

### Data sources

This study collected data from databases of 44 general practitioners (GPs) of the Local Health Unit (LHU) of Bologna in Italy. The structure of this database has been described in detail elsewhere.<sup>17,18</sup>

Briefly, the database included different sections as follows: 1) patient data, such as gender and date of birth; 2) prescription records with information on the drugs dispensed by the retail pharmacies in the territory; 3) hospital data, the discharge diagnosis codes classified according to the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM); 4) prescription records for diagnostic tests and 5) the exemptions database, records for exemptions, which includes the exemption code (identifying the disease for which the exemption was granted). All drugs prescribed were classified according to the codes of International Anatomic Therapeutic Chemical

(ATC) Classification System. In compliance with privacy laws, the patients' identification codes were encrypted. The sections were linked by an encrypted unique identification code according to the Italian law for confidentiality data. No identifiers linking individuals to the data were provided to the researchers, and the authors were never involved in collecting the patient data from patients at any point. The anonymous data file was routinely used by the regional health authorities for epidemiological and administrative purposes. Informed consent was not required for using encrypted retrospective information. This study was notified to the local ethics committee of each participating LHU according to the Italian law regarding the conduct of observational analysis, and the ethics committee of LHU approved the study.<sup>19</sup>

### Study population

From January 1, 2009, to December 31, 2012, the patient files of all subjects aged  $\geq 18$  years cared by the 44 GPs enrolled in the study were analyzed, and the subjects with a diagnosis of AF (supported by electrocardiographic findings or the diagnosis recorded on a hospital discharge summary) were included in the analysis.

The index date was defined as the date of the first qualifying AF diagnosis, and all patients enrolled were followed for 1 year after the enrollment date. According to their first prescription of ATs during the enrollment period, the patients were stratified into the following four main categories: 1) monotherapy with OACs (warfarin or acenocumarol); 2) monotherapy with APs (acetylsalicylic acid or clopidogrel); 3) prescriptions of both an OAC agent and an AP agent and 4) without therapy.

The CHA<sub>2</sub>DS<sub>2</sub>-VASc score<sup>1</sup> (where points are attributed to the presence of known risk factors: congestive heart failure or left ventricular systolic dysfunction, hypertension history, vascular disease, age  $\geq 75$  years, diabetes mellitus, prior stroke/transient ischemic attack [TIA] or thromboembolism and gender category) was calculated, and the patients were stratified in various risk levels; a score of  $\geq 2$  indicated a risk for thromboembolism requiring anticoagulation. The scores considered in this study ranged from 0 to 5+. Because the risk of bleeding is also an important concern,<sup>9</sup> the HAS-BLED (hypertension, abnormal renal and liver function, stroke, bleeding, labile international normalized ratio [INR], elderly [age >65 years], drugs [other AP agents or nonsteroidal anti-inflammatory drugs {NSAIDs}] or alcohol history) score was calculated to evaluate an individual patient's risk for bleeding.<sup>1</sup> An HAS-BLED score of  $\geq 3$  is associated with a high bleeding risk. The HAS-BLED score was categorized as 0

through 5+ in this study. Because in our database information on labile INR and alcohol use was not available for all patients according to a previous analysis,<sup>20</sup> we calculated a modified HAS-BLED score with a maximum score of 8 instead of 9. The CHA<sub>2</sub>DS<sub>2</sub>-VASc and HAS-BLED scores were calculated only for patients for whom gender data were available.

When available, the number of INR tests in the period after the index date was assessed. The following covariates were assessed for each patient at the index date: 1) demographic variables; 2) risk factors for stroke, such as previous stroke/TIA/hemorrhagic stroke (ICD-9-CM codes: 430–436, 438, 442), valve disease (ICD-9-CM codes: 394, 424.0), diabetes (ICD-9-CM code: 250), peripheral vascular disease (ICD-9-CM codes: 433.1, 440.2, 443.9), hypertension (ICD-9-CM codes: 401–404), heart failure (ICD-9-CM code: 428) and coagulation defects (ICD-9-CM codes: 286, 287); 3) other disease, such as peptic ulcer (ICD-9-CM codes: 531–534); hemorrhage/bleeding (ICD-9-CM codes: 456.0, 531.0, 531.2, 531.4, 531.6, 532.0, 532.2, 532.4, 532.6, 533.0, 533.2, 533.4, 533.6, 534.0, 534.2, 534.6, 569.3, 578.0, 578.9, 596.7, 599.7, 626.5, 626.6, 626.9, 627.0, 627.1, 623.8, 626.2, 784.7, 786.3, 459.0, 719.1, 423.0, 379.2, 852.2); chronic bronchitis (ICD-9-CM code: 491), in particular obstructive chronic bronchitis (ICD-9-CM code: 491.2); asthma (ICD-9-CM code: 493); gastroesophageal reflux (ICD-9-CM code: 530.81); disorders of thyroid gland (ICD-9-CM codes: 240–246); dementia (ICD-9-CM code: 290); other cerebral degenerations (ICD-9-CM code: 331); sleep apnea (ICD-9-CM codes: 780.51, 780.53, 780.57) and bone fractures (ICD-9-CM codes: 805, 806, 808, 820, 824, 812.0–812.5, 813.4, 813.5, 807.0, 807.1); 4) test prescription and resource usage related to AF management, such as cardiologic visits, echocardiograms (ECGs) and ECG with Holter and mechanical heart valves prior to the index date and 5) all prescriptions due to the use of beta blocker ( $\beta$ -blocker) agents (ATC code: C07), statins (ATC code: C10AA), organic nitrates (ATC code: C01DA), antidiabetic drugs (ATC codes: A10A, A10B), anti-inflammatory and anti-rheumatic agents and non-steroids (ATC code: M01A), macrolides (ATC code: J01FA) and proton pump inhibitors (ATC code: A02BC) 6 months before the data index.

## Compliance with therapy among OAC users

Persistence to therapy in terms of the percentage of patients still on treatment with the index drug during the last 3 months of observation was also assessed. Patients were excluded if they had a procedure of electrical cardioversion (ICD-9-CM

procedure code: 99.6). An interruption of treatment was defined as the absence of prescriptions in the last 3 months of the observation period. This method is validated and has been used in previous studies.<sup>21,22</sup>

## Statistical analysis

Standard descriptive statistical methods were used to analyze the patient's demographics and clinical status, to evaluate the proportion of treated patients in each drug category and to calculate the cohort of patients still on treatment with the index drug. In cases where data were not issuable for data privacy – results referred to less than four patients, as potentially re-identifiable to single individuals “Codice in materia di protezione dei dati personali [Code for protection of personal data]”<sup>38</sup> – they have been reported as NI (not issuable). Statistical analyses were performed using Stata software version (StataCorp LP, College Station, TX, USA).

## Results

From 2009 to 2012, we identified 1,413 patients with a diagnosis of AF (2.09% of 67,517 patients of the 44 GPs). The numbers of patients identified during the 4 years of data screening were 365 and 354 in 2009 and 2010, respectively, and 346 and 348 in 2011 and 2012, respectively; of these patients, 49.9% were males. The frequency of AF increased with age, with a significant majority of cases observed in the elderly population. A total of 934 patients (66.1%) had at least one cardiologic visit in the year prior to the index. During the 6 months before the index date, 33.2% patients had at least one prescription for  $\beta$ -blockers, while 27.3% and 20% patients had at least one prescription for proton pump inhibitors and statins, respectively. The baseline characteristics of the patients, stratified according to the treatment assignment, are described in Table 1.

At the time of the analysis, 559 patients (39.56% of all patients with AF) were treated with OACs, 424 patients (30% of all patients with AF) received AP agents and 200 patients (14% of all patients with AF) were without any prescription for ATs. Prescriptions for both an OAC and AP agent were given to 16.28% of patients; of these patients, only 4.17% were given an OAC plus an AP agent at the same time. The distribution of the study population stratified by treatment strategy assignment 1 year after the index date is shown in Table 2.

In the entire study population, the most frequent CHA<sub>2</sub>DS<sub>2</sub>-VASc scores were 4, 3 and 5+, occurring in 31.6%, 26.1% and 18% of patients, respectively (Table 3). The distribution of ATs use according to stroke risk categories is

**Table 1** Clinical and demographic characteristics stratified by treatment strategy assignment

	OAC, n (%)	AP, n (%)	Both prescriptions, n (%)	None, n (%)	Total, n (%)
Year of diagnosis	559 (100.0)	424 (100.0)	230 (100.0)	200(100.0)	1,413 (100.0)
2009	145 (39.7)	119 (32.6)	58 (15.9)	43 (11.8)	365 (100.0)
2010	146 (41.2)	98 (27.7)	61 (17.2)	49 (13.8)	354 (100.0)
2011	130 (37.6)	119 (34.4)	54 (15.6)	43 (12.4)	346 (100.0)
2012	138 (39.7)	88 (25.3)	57 (16.4)	65 (18.7)	348 (100.0)
Males*	262 (48.2)	200 (48.1)	132 (58.7)	95 (48.5)	689 (49.9)
Age groups (years)					
<30	–	NI	–	4 (2.0)	5 (0.4)
30–64	47 (8.4)	63 (14.9)	30 (13.0)	52 (26.0)	192 (13.6)
65–74	106 (19.0)	90 (21.2)	58 (25.2)	35 (17.5)	289 (20.5)
75–84	273 (48.8)	131 (30.9)	101 (43.9)	59 (29.5)	564 (39.9)
≥85	133 (23.8)	139 (32.8)	41 (17.8)	50 (25.0)	363 (25.7)
Previous diseases					
Stroke	109 (19.5)	70 (16.5)	60 (26.1)	24 (12.0)	263 (18.6)
Transient ischemic attack	31 (5.5)	14 (3.3)	14 (6.1)	7 (3.5)	66 (4.7)
Hemorrhagic stroke	NI	NI	–	NI	5 (0.4)
Bleeding/hemorrhage	61 (10.9)	34 (8.0)	23 (10.0)	18 (9.0)	136 (9.6)
Valve disease	75 (13.4)	29 (6.8)	18 (7.8)	18 (9.0)	140 (9.9)
Heart failure	92 (16.5)	43 (10.1)	19 (8.3)	18 (9.0)	172 (12.2)
Hypertension	516 (92.3)	375 (88.4)	210 (91.3)	143 (71.5)	1,244 (88.0)
Diabetes	90 (16.1)	66 (15.6)	46 (20.0)	24 (12.0)	226 (16.0)
Peripheral vascular disease	72 (12.9)	61 (14.4)	49 (21.3)	15 (7.5)	197 (13.9)
Bone fractures	51 (9.1)	43 (10.1)	24 (10.4)	15 (7.5)	133 (9.4)
Peptic ulcer	34 (6.1)	33 (7.8)	13 (5.7)	13 (6.5)	93 (6.6)
Coagulation defects	15 (2.7)	8 (1.9)	5 (2.2)	NI	31 (2.2)
Chronic bronchitis	48 (8.6)	30 (7.1)	18 (7.8)	8 (4.0)	104 (7.4)
Obstructive chronic bronchitis	27 (4.8)	11 (2.6)	14 (6.1)	NI	55 (3.9)
Asthma	20 (3.6)	16 (3.8)	10 (4.3)	8 (4.0)	54 (3.8)
Gastroesophageal reflux	58 (10.4)	50 (11.8)	27 (11.7)	25 (12.5)	160 (11.3)
Disorders of thyroid gland	111 (19.9)	86 (20.3)	42 (18.3)	38 (19.0)	277 (19.6)
Dementia	11 (2.0)	11 (2.6)	–	5 (2.5)	27 (1.9)
Other cerebral degenerations	4 (0.7)	NI	–	–	5 (0.4)
Sleep apnea	14 (2.5)	9 (2.1)	5 (2.2)	NI	29 (2.1)
Myocardial infarction	43 (7.7)	48 (11.3)	35 (15.2)	6 (3)	132 (9.3)
Drug use 6 months before index date					
b-blocker agents	211 (37.7)	130 (30.7)	90 (39.1)	38 (19.0)	469 (33.2)
Statins	107 (19.1)	88 (20.8)	75 (32.6)	13 (6.5)	283 (20.0)
Organic nitrates	26 (4.7)	32 (7.5)	14 (6.1)	NI	75 (5.3)
Antidiabetic drugs	61 (10.9)	48 (11.3)	37 (16.1)	10 (5.0)	156 (11.0)
FANS	35 (6.3)	25 (5.9)	16 (7.0)	6 (3.0)	82 (5.8)
Macrolides	NI	NI	5 (2.2)	–	9 (0.6)
Proton pump inhibitors	148 (26.5)	115 (27.1)	75 (32.6)	48 (24.0)	386 (27.3)
Antiarrhythmics	47 (8.4)	35 (8.3)	21 (9.1)	12 (6.0)	115 (8.1)
Other healthcare resource used prior to the index date					
Cardiologic visits	407 (72.8)	246 (58.0)	174 (75.7)	107 (53.5)	934 (66.1)
ECGs with Holter	212 (37.9)	136 (32.1)	87 (37.8)	71 (35.5)	506 (35.8)
ECGs	213 (38.1)	97 (22.9)	76 (33.0)	51 (25.5)	437 (30.9)
Prosthetic heart valves	11 (2.0)	–	NI	NI	17 (1.2)

**Note:** \*Value was calculated only for patients for whom gender data were available (n=1,381).

**Abbreviations:** OAC, oral anticoagulant; AP, antiplatelet; b-blocker, beta blocker; ANS, anti-inflammatory and antirheumatic agents and non-steroids; ECG, echocardiogram; NI, not issuable.

reported in Figure 1. We evaluated the HAS-BLED score; the results showed that a low proportion of patients had a high and a low HAS-BLED score, with the majority of patients having a moderate bleeding risk score (Table 3). The given combinations between the treatment options for each patient

and the HAS-BLED scores are summarized in Figure 2. Data regarding INR tests were available in 64.6% of all patients treated with OACs. Among the OAC users, the percentage of patients still on treatment with the index drug during the last 3 months of observation was 76.9%.

**Table 2** Distribution of the study population stratified by treatment strategy assignment 1 year after the index date

Treatment strategy assignment	3 months		6 months		1 year	
	Patients (n=1,413)	%	Patients (n=1,413)	%	Patients (n=1,413)	%
OAC	554	39.2	576	40.8	559	39.6
AP	408	28.9	425	30.1	424	30.0
Prescriptions of both an OAC agent and an AP agent	123	8.7	171	12.1	230	16.3
None	328	23.2	241	17.1	200	14.2

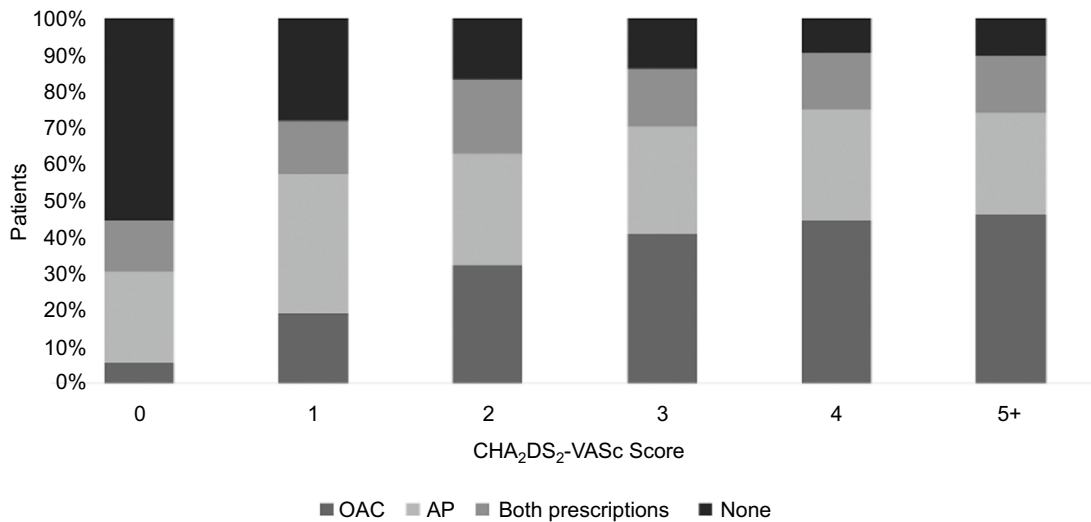
**Abbreviations:** OAC, oral anticoagulant; AP, antiplatelet.

**Table 3** Distribution of stroke risk and bleeding risk of patients according to the CHA<sub>2</sub>DS<sub>2</sub>-VASc and HAS-BLED scores, respectively

Score/risk category	Distribution of patients <sup>#</sup> according to CHA <sub>2</sub> DS <sub>2</sub> -VASc score, n (%)	Distribution of patients <sup>#</sup> according to HAS-BLED score, n (%)
0	36 (2.6)	98 (7.1)
1	89 (6.4)	409 (29.6)
2	204 (14.8)	617 (44.7)
3	358 (25.9)	204 (14.8)
4	441 (31.9)	41 (3.0)
5+	253 (18.3)	12 (0.9)

**Note:** <sup>#</sup>HAS-BLED and CHA<sub>2</sub>DS<sub>2</sub>-VASc scores were calculated only for patients for whom gender data were available (n=1,381).

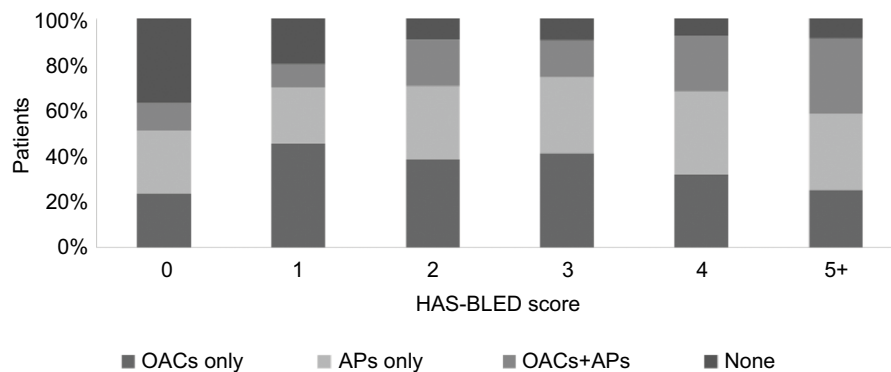
**Abbreviations:** HAS-BLED, hypertension, abnormal renal and liver function, stroke, bleeding, labile INR, elderly (age >65 years), drugs (other AP agents or NSAIDs) or alcohol history; INR, international normalized ratio; AP, antiplatelet; NSAID, nonsteroidal anti-inflammatory drug.



**Figure 1** Stratification of treatment strategy assignment per risk category according to CHA<sub>2</sub>DS<sub>2</sub>-VASc score.

**Note:** The CHA<sub>2</sub>DS<sub>2</sub>-VASc score was calculated only for patients where gender data were available (n=1,381).

**Abbreviations:** OAC, oral anticoagulant; AP, antiplatelet.



**Figure 2** Stratification of treatment strategy assignment per bleeding risk category according to the HAS-BLED score.

**Note:** The HAS-BLED score was calculated only for patients where gender data were available (n=1,381).

**Abbreviations:** HAS-BLED, hypertension, abnormal renal and liver function, stroke, bleeding, labile INR, elderly (age >65 years), drugs (other AP agents or NSAIDs) or alcohol history; OAC, oral anticoagulant; AP, antiplatelet; INR, international normalized ratio; NSAID, nonsteroidal anti-inflammatory drug.



## Discussion

AF is the most common sustained arrhythmia in Italy.<sup>17,18</sup> We studied, retrospectively, a population of 1,413 patients with AF cared by 44 GPs. The AF prevalence varies considerably between countries, although this variance might partially be a function of the differences in the methods of data collection and the demographic characteristics of the populations investigated.<sup>23,24</sup> In previous studies, the prevalence and incidence were higher in men than woman,<sup>23</sup> whereas in our study, the opposite trend was observed. In our study, the prevalence of AF was 2.09%; this value is in accordance with what was reported previously in a retrospective Italian study (on patients being cared for by 233 GPs, homogeneously distributed across Italy), in which the prevalence of AF was estimated to be of 1.85%.<sup>18</sup>

The profile of comorbidities at baseline was in agreement with previous analyses and showed that hypertension was the most prevalent condition associated with AF patients.<sup>18,25</sup>

Our study shows that a considerable proportion of AF patients did not receive any prescription of ATs. Moreover, our finding shows that 55.8% of all patients enrolled were treated with OACs (39.56% were prescribed an OAC and 16.2% had both prescriptions during the observation period); the OAC use rate was lower than expected compared with the Euro Heart Survey (where, among 2,706 patients enrolled, ~64% patients received OAC due to AF)<sup>26</sup> or European countries.<sup>27,28</sup> Our underutilization of OAC is in accordance with data observed in other two Italian studies. The survey conducted by Mazzaglia et al<sup>18</sup> from 2001 to 2004 showed that in patients with AF, the use of OACs and AP agents was 26.6% and 30.7%, respectively, and 5.5% of patients had both prescriptions. In the recent study, ISAF,<sup>17</sup> in which a diagnosis of AF was confirmed in 2.04% of all the patients screened, only 46% of the entire population received OACs, 37.5% were taking AP agents and 16.5% had no AT treatment at all. Taken together, these data indicate that despite the growth in the awareness of the benefits of anticoagulation as a treatment for AF, the underuse of OAC remains evident. In 2007, the ARNO Cardiovascular Observatory documented a percentage of OACs prescription of 42.7% in patients with a primary diagnosis of AF and 37.7% in patients with a secondary diagnosis of AF from hospital discharge records in the first month of follow-up post-discharge.<sup>29</sup>

In the present study, we calculated the levels of stroke and bleeding risks according to risk stratification schemes. Although, HAS-BLED score is now recommended in European guideline<sup>1,30</sup> to estimate major bleeding risk in

anticoagulated AF patients, physicians rarely take into consideration HAS-BLED in prescribing the therapy. This could be explained by the fact that many risk factors for stroke are also risk factors for bleeding. A substantial percentage of patients were associated with moderate and high scores; based on this risk profile, although AT therapy is highly recommended in AF patients with a CHA<sub>2</sub>DS<sub>2</sub>-VASc score of >2, we report underuse of AT therapies. OACs appear to be underused, even in patients with a high risk of stroke who might benefit from such medication. A recent review reported underuse of OAC in high-risk patients.<sup>13</sup> In addition, the AntiThrombotic Agents in Atrial Fibrillation (ATA-AF) study, performed in 2012, showed that a considerable underuse of OAC was observed in eligible high-risk patients, in whom the prescription rate was only 56%.<sup>25</sup>

It is unclear why AF patients are untreated and guidelines are not followed in clinical practice. A recent Italian study<sup>31</sup> analyzed the levels of knowledge and information on AF in the Italian population and the level of AF risk awareness by GPs and AF patients. The results showed that only one-third of Italians know that AF is perceived as a severe disease. In addition, Gensini et al<sup>31</sup> showed an underuse of the scores for thromboembolic and hemorrhagic risk stratification recommended by the current guidelines and a frequent use of AP agents rather than OAC therapy.

When the analysis was conducted, there were no data available about novel oral anticoagulants (NOACs); nevertheless, recently published studies show that adoption of NOACs might have a positive effect on the undertreatment of AF.<sup>32-34</sup>

In the current study, among the patients treated with OACs, >75% of all OACs users were still on treatment during the last months of the follow-up period. A number of studies have reported that noncompliance with anticoagulation therapy could have a significant clinical effect by increasing the thromboembolic and stroke risk, which could lead to prolonged hospital admissions and residential care and could play an important role in increasing the consumption of health care resources and in worsening morbidity and mortality.<sup>35,36</sup> During OAC therapy, the frequent performing of coagulation tests reminds the patient of the importance of such treatment, and the rate of discontinuation could be indicated by abnormal INR results. In our analysis, a percentage of OAC patient records did not contain information on the INR, and we could not establish if INR tests were not performed or if the INR values were not reported in our database. Although the monitoring requirements of OACs are generally thought

of as a negative factor discouraging OAC use, regular monitoring measures of patients' compliance and the interface with expert health care providers might improve compliance to treatment.<sup>37</sup> The lack of information on the INR monitoring in the administrative database points toward the need for a greater effort in formation/communication with GPs.

Our analysis has several limitations inherent to any observational study. First, the analyses were performed using the databases of one LHU; although GPs in Bologna have a well-managed collaborative audit project that could lead to actual health care benefits for users and great improvement in health care quality, the findings of this study must be interpreted with caution, and further larger studies are required to confirm these results. A second limitation is the relatively small sample size of patients with a confirmed diagnosis of AF. A third limitation of this study is that the reasons for noncompliance with treatment in the patients are not retrievable from the dataset. For this reason, we cannot exclude that the occurrence of important contraindications or the use of concomitant treatment with potentially interacting medication might also explain the treatment discontinuation. In addition, no important clinical information was available to us. Finally, the OAC daily dose is extremely variable, because it is dependent on patient-related factors; therefore, the precision of the method used to calculate the percentage of patients still on treatment with the index drug during the observation period is likely to be limited.

## Conclusion

Our study emphasizes that in an Italian real-world setting, the burden of AF in general population from a public health point of view underscores the need for improvement in utilization of appropriate ATs in patients with known AF.

The present findings suggest that a proportion of patients do not receive or discontinue therapy for AF management. Considering these findings, other studies are needed to identify the reason why AF treatment is not optimal and the relevance of the implementation of educational interventions aimed at improving the clinical management of patients with AF.

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## Author contributions

All authors contributed toward data analysis, drafting and critically revising the paper and agree to be accountable for all aspects of the work .

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The authors have no conflicts of interest to disclose. The opinions expressed in this article do not necessarily reflect the views of the authors' institutions.

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