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Background and Purpose—The purpose of this study was to investigate the impact of improved antithrombotic treatment in atrial fibrillation after the introduction of non–vitamin K antagonist oral anticoagulants on the incidence of stroke and bleeding in a real-life total population, including both primary and secondary care.

Methods—All resident and alive patients with a recorded diagnosis for atrial fibrillation during the preceding 5 years in the Stockholm County Healthcare database (Vårdanalysdatabasen) were followed for clinical outcomes during 2012 (n=41 008) and 2017 (n=49 510).

Results—Pharmacy claims for oral anticoagulants increased from 51.6% to 73.8% (78.7% among those with CHA_2DS_2-VASc ≥2). Non–vitamin K antagonist oral anticoagulant claims increased from 0.4% to 34.4%. Ischemic stroke incidence rates decreased from 2.01 per 100 person-years in 2012 to 1.17 in 2017 (incidence rate ratio, 0.58; 95% CI, 0.52–0.65). The largest increases in oral anticoagulants use and decreases in ischemic strokes were seen in patients aged ≥80 years who had the highest risk of stroke and bleeding. The incidence rates for major bleeding (2.59) remained unchanged (incidence rate ratio, 1.00; 95% CI, 0.92–1.09) even in those with a high bleeding risk. Poisson regression showed that 10% of the absolute ischemic stroke reduction was associated with increased oral anticoagulants treatment, whereas 27% was related to a generally decreased risk for all stroke.

Conclusions—Increased oral anticoagulants use contributed to a marked reduction of ischemic strokes without increasing bleeding rates between 2012 and 2017. The largest stroke reduction was seen in elderly patients with the highest risks for stroke and bleeding. These findings strongly support the adoption of current guideline recommendations for stroke prevention in atrial fibrillation in both primary and secondary care. **(*Stroke*. 2018;49:2122-2128. DOI: 10.1161/STROKEAHA.118.021990.)**

Key Words: anticoagulants ■ atrial fibrillation ■ incidence ■ stroke ■ warfarin

Atrial fibrillation (AF) is the most common cardiac arrhythmia with a prevalence of at least 3% in the adult population of Sweden.[1] AF is a major risk factor for stroke, giving patients with this condition a 5-fold increased risk of suffering a stroke.[2] Both the prevalence of AF and the related stroke risk increase markedly in the elderly.[2] Treatment with an oral anticoagulant (OAC) reduces the risk for stroke effectively.[3–5] Vitamin K antagonists, such as warfarin have been the mainstay for stroke prevention in AF patients for several decades.[6] However, many patients, especially the elderly and frail, have received less efficient but not safer acetylsalicylic acid (ASA) or no antithrombotic treatment at all.[7] Previous studies in Sweden indicated that the largest preventable stroke burden was among elderly patients not receiving warfarin treatment.[8,9]

Four pivotal trials have shown the efficacy and safety of the non–vitamin K antagonist OACs (NOACs) dabigatran, rivaroxaban, apixaban, and edoxaban compared with warfarin.[10–13] Numerous observational studies have corroborated their safety and effectiveness in clinical practice.[14,15] The

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accumulating evidence has resulted in revisions of guideline recommendations[16–18] and has been associated with substantial increases in the utilization of NOACs in clinical practice all over the world,[19] as well as in the Stockholm healthcare region.[20] However, particularly in AF patients with a high stroke risk, in whom also bleeding concerns are common,[8] OACs have continued to be underused resulting in preventable strokes.[19,21]

In addition to the early warfarin and ASA trials,[4] 2 relatively recent randomized studies have shown superiority of OAC compared with ASA treatment in AF patients. However, these patients were relatively young and without serious comorbidities in 1 study,[5] and the majority of fragile patients were not considered eligible in the other.[22] The American AF guidelines recommend either warfarin or a NOAC for patients with CHA_2DS_2-VASc ≥2 with careful consideration to balance the benefits and risks of bleeding in each individual patient.[18] The European AF guidelines prioritized NOACs over warfarin already in 2012 and have recently abandoned the recommendation to use the HAS-BLED scale (hypertension, abnormal renal and liver function, stroke, bleeding, labile INR, elderly, drugs or alcohol) to evaluate bleeding risk in favor of reducing modifiable risk factors and treating also patients with a high bleeding risk with OACs.[16] Both guidelines recommend strongly against prescribing ASA unnecessarily. Thus, the question remains what risks and benefits can be seen with increasing OAC and decreasing ASA treatment in an entire nonselected AF population, which includes treatment of old and fragile patients in primary care.

The present study aims to investigate how antithrombotic treatment strategies and ischemic stroke and bleeding rates have changed after the adoption of recommendations for increased anticoagulant treatment and decreased utilization of ASA in AF. We compared these clinical outcomes in the entire AF populations of the Stockholm County during 2012 and 2017.

Methods

Data Source

We conducted a retrospective cohort study, using the Stockholm Healthcare Analyses Database (Vårdanalysdatabasen).[7] Vårdanalysdatabasen contains pseudonymized individual-level data for all inhabitants in the region (2.09 million in 2011 and 2.27 million in 2016), from both primary and secondary care, giving the unique possibility of complete healthcare data for follow-up of virtually all inhabitants.[7] Demographic information, prescription claims, diagnoses, and healthcare consultations are linked using the personal identity number of each inhabitant.[23] Data on secondary care (outpatient visits and hospitalizations) have been registered since 1993, primary care data since 2003, and pharmacy claims data since July 2010. Pharmacy data cover claims anywhere in the country and consist of amounts dispensed, expenditures and reimbursement, the age and sex of the patient, copayments, and prescriber category.[24]

The study was approved by the Regional Ethical Review Board in Stockholm (EPN 2015/579-31/2). Informed consent was not required in this registry study of anonymized data. Data are available on request from the authors.

Patient Selection

We created 2 cohorts for follow-up of clinical outcomes during 2012 and 2017, respectively. For *International Classification of Diseases Tenth Revision* and Anatomical Therapeutic Chemical (ATC) codes (Table I in the online-only Data Supplement). All patients, alive and residents of the Stockholm County on December 31, 2011 and December 31, 2016, with a recorded diagnosis code for AF in the previous 5 years, were identified. Patients were excluded if they had a code for mechanical valves or mitral stenosis[16] or if they moved into the region during the 5 years before the index date.

Treatment, Risk, and Outcome Definition

Treatments were assessed based on a claim of any OAC in 2011 and 2016, respectively. Sensitivity analyses were conducted by defining treatment based on a claim in the last 6 months of 2011 and 2016. An additional analysis investigated patients switching and stopping treatment in the year of outcome.

The stroke risk was estimated with the CHA_2DS_2-VASc score.[25] Bleeding risk was assessed using a modified HAS-BLED score because international normalized ratio values were not available[26] (hypertension +1, abnormal liver function +1, abnormal renal function +1, previous stroke +1, prior bleeding or anemia +1, age >65+1, alcohol misuse +1, medication use predisposing to bleeding +1). A HAS-BLED score of 3 to 8 was considered high risk. Comorbidities were based on diagnoses recorded during the 5 years before the inclusion date.

The primary effectiveness outcome was ischemic stroke in acute somatic inpatient care as a primary or secondary diagnosis.[14] For safety, the primary outcome was a major bleed in acute somatic inpatient or outpatient care, including hemorrhagic stroke, intracranial bleeding, bleeding requiring hospitalization, and gastrointestinal bleeding.[14] Outcomes were assessed with censoring for death and migration. Rates of transient ischemic attack/ischemic and unspecified stroke and total mortality are also reported.[14]

In addition, exploratory comparisons of ischemic stroke and severe bleed in 2017 in patients with prevalent NOAC or warfarin treatment are presented. Patients who switched treatment during 2016 were excluded.

Statistical Analysis

Basic descriptive statistics were used to describe the cohorts. With a Poisson regression, we calculated incidence rates (IR) and 95% CIs to compare outcomes between 2012 and 2017. Predefined stratified analyses were made for age, stroke, and bleeding risk groups.

To examine the influence of changed OAC-treatment strategies on ischemic stroke and major bleeds, we used stepwise adjustment for changes in demographic characteristics, baseline stroke and bleeding risks, and finally for OAC treatment

Results

Clinical Characteristics

A total of 41 008 and 49 510 patients with nonvalvular AF were included in the 2012 and 2017 cohorts, respectively (Figure I in the online-only Data Supplement). This corresponds to 2.6% and 2.9% of the total adult populations of the Stockholm County. The demographics, clinical characteristics, CHA_2DS_2-VASc, and HAS-BLED scores of the 2 cohorts were similar (Table 1).

Antithrombotic Treatment

In the 2012 cohort, 51.6% of the patients received treatment with any OAC, whereas there was a substantial increase to 73.8% in the 2017 cohort (Table 2). A corresponding decrease could be seen in the number of patients with ASA monotherapy from 32.1% to 10.4%. In the 2017 cohort, 39.3%% had claimed only warfarin, and 34.4% claimed a NOAC. The proportion of patients receiving no antithrombotic treatment (ie, neither OAC nor ASA) was similar. In the 2017 cohort, a larger proportion of the patients remained on OAC treatment

Table 1. Baseline Table With Patient Characteristics in Each Cohort

	2012 (n=41 008)	2017 (n=49 510)
Male	22 818 (55.6%)	28 424 (57.4%)
Age, y, mean (SD)	74.6 (12.5)	75.0 (11.9)
0–39	574 (1.4%)	509 (1.0%)
40–64	7115 (17.4%)	7545 (15.2%)
65–74	10 808 (26.4%)	14 344 (29.0%)
75–79	6150 (15.0%)	8327 (16.8%)
≥80	16 361 (39.9%)	18 785 (37.9%)
CHA2DS2-VASc score, mean (SD)	3.62 (1.9)	3.66 (1.9)
0	2368 (5.8%)	2560 (5.2%)
1	3875 (9.5%)	4183 (8.5%)
2–4	21 320 (52.0%)	26 594 (53.7%)
5–9	13 445 (32.8%)	16 173 (32.7%)
HAS-BLED score, mean (SD)	2.37 (1.24)	2.28 (1.22)
0	2543 (6.2%)	3289 (6.6%)
1–2	20 508 (50.0%)	26 680 (53.9%)
≥3	17 957 (43.8%)	19 541 (39.5%)
Heart failure	13 408 (32.7%)	14 979 (30.3%)
Hypertension	25 990 (63.4%)	34 372 (69.4%)
TIA/stroke/systemic embolism	8007 (19.5%)	10 398 (21%)
Vascular disease	11 545 (28.2%)	11 862 (24.0%)
Diabetes mellitus	7891 (19.2%)	10 034 (20.3%)
Abnormal renal function	2866 (7.0%)	5524 (11.2%)
Abnormal liver function	555 (1.4%)	791 (1.6%)
Previous bleeding	2979 (7.3%)	4479 (9.1%)
Anemia	6497 (15.8%)	9897 (20.0%)
Alcohol misuse	1562 (3.8%)	1865 (3.8%)
Cancer	7783 (19.0%)	10 630 (21.5%)
Falls	3662 (8.9%)	6770 (13.7%)
Chronic obstructive pulmonary disease	3921 (9.6%)	5043 (10.2%)
Dementia	2589 (6.3%)	3462 (7.0%)
Obesity	2375 (5.8%)	3097 (6.3%)
Rate control drugs	29 839 (72.9%)	37 356 (75.5%)
Rhythm control drugs	3674 (8.9%)	3094 (6.3%)
Low-molecular weight heparins	2369 (5.8%)	2505 (5.1%)
Clopidogrel	1221 (3.0%)	1319 (2.7%)
Ticagrelor	9 (0.0%)	155 (0.3%)
Prasugrel	18 (0.0%)	11 (0.0%)
Antihypertensive drugs	37 067 (90.4%)	44 891 (90.7%)
Lipid-lowering drugs	15 201 (37.1%)	19 791 (40.0%)
Insulin	2743 (6.7%)	3496 (7.1%)
Oral antidiabetic drugs	3811 (9.3%)	5079 (10.3%)
Proton pump inhibitors	10 148 (24.8%)	13 258 (26.8)

CHA2DS2-VASc indicates congestive heart failure, hypertension, age ≥75 years, diabetes mellitus, stroke or TIA or thromboembolism, vascular disease, age 65–74 years, sex category; HAS-BLED, hypertension, abnormal renal and liver function, stroke, bleeding, labile INR, elderly, drugs or alcohol; and TIA, transient ischemic attack.

Table 2. Antithrombotic Treatment Strategies in Each Cohort

Treatment	2012 (n=41 008)	2017 (n=49 510)
OAC, n (%)	21 152 (51.6)	36 515 (73.8)
0–39 y	61 (10.6)	76 (14.9)
40–64 y	2874 (40.4)	3759 (49.8)
65–74 y	6682 (61.8)	11 701 (81.6)
75–79 y	4002 (65.1)	7031 (84.4)
≥80 y	7533 (46.0)	13 948 (74.3)
CHA_2DS_2-VASc 0	559 (23.6)	544 (21.3)
HAS-BLED 0	412 (25.9)	475 (22.0)
HAS-BLED 1–2	145 (18.9)	68 (17.7)
HAS-BLED 3+	2 (20.0)	1 (8.3)
CHA_2DS_2-VASc 1	1599 (41.3)	2303 (55.1)
HAS-BLED 0	274 (32.8)	339 (34.0)
HAS-BLED 1–2	1296 (45.2)	1930 (62.9)
HAS-BLED 3+	29 (17.0)	34 (28.3)
CHA_2DS_2-VASc 2–4	11 913 (55.9)	21 131 (79.5)
HAS-BLED 0	83 (71.6)	96 (74.4)
HAS-BLED 1–2	9376 (67.8)	16 338 (85.7)
HAS-BLED 3+	2454 (33.3)	4697 (63.6)
CHA_2DS_2-VASc 5–9	7081 (52.7)	12 537 (77.5)
HAS-BLED 0	0	0
HAS-BLED 1–2	2494 (81.9)	3817 (91.9)
HAS-BLED 3+	4587 (44.1)	8720 (72.6)
Warfarin	21 050 (51.3)	21 323 (43.1)
NOAC	178 (0.4)	17 040 (34.4)
Only warfarin	20 974 (51.2)	19 475 (39.3)
ASA, n (%)	16 491 (40.0)	7931 (16.0)
No OAC	12 992 (31.7)	5112 (10.3)
No ASA or OAC, n (%)	6864 (16.7)	7883 (15.9)

ASA indicates acetylsalicylic acid; CHA_2DS_2-VASc, congestive heart failure, hypertension, age ≥75 years, diabetes mellitus, stroke or TIA or thromboembolism, vascular disease, age 65 -74 years, sex category; HAS-BLED, hypertension, abnormal renal and liver function, stroke, bleeding, labile INR, elderly, drugs or alcohol; NOAC, non–vitamin K OAC; and OAC, oral anticoagulant.

in the year of outcome, and more patients switched from no OAC treatment to OAC treatment, compared with 2012 (Table II in the online-only Data Supplement).

The proportion of patients treated with an OAC increased in all age groups (Table 2). Notably, the largest increase was among the elderly (≥80 years of age), from 47.0% to 74.1%, as well as among potentially frail patients with simultaneously high CHA_2DS_2-VASc and HAS-BLED scores (Table 2).

Ischemic Stroke, Major Bleeding, and Total Mortality

Ischemic stroke IR decreased from 2.01 per 100 person-years in 2012, to 1.17 in 2017 (IR ratio [IRR], 0.58; 95%

Table 3. All Safety and Effectiveness Outcomes for the Whole AF Population in 2012 and 2017

	2012 (n=41 008)	2017 (n=49 510)	IRR (95% CI)
Effectiveness, (IR)			
Ischemic Stroke	2.01	1.18	0.58 (0.52–0.65)
TIA/ischemic stroke/ unspecified stroke	2.70	1.72	0.64 (0.58–0.70)
Safety, (IR)			
Major bleeds	2.59	2.59	1.00 (0.92–1.09)
Hospitalized bleeds	1.98	1.74	0.88 (0.79–0.97)
Intracranial bleeds	0.78	0.85	1.09 (0.94–1.27)
Hemorrhagic stroke	0.31	0.28	0.90 (0.70–1.15)
Gastrointestinal bleeds	1.12	1.18	1.05 (0.93–1.20)

AF indicates atrial fibrillation; IR, incidence rate per 100 person-years; IRR, incidence rate ratio; and TIA, transient ischemic attack.

CI, 0.52–0.65; Table 3). The reduction of ischemic stroke was to a large extent driven by fewer strokes among elderly and high-risk patients (Figure 1A and 1B). The total mortality (death as a noncompeting outcome) was significantly lower in the AF population in 2017 (IRR, 0.90; 95% CI, 0.86–0.95).

Regarding safety outcomes, there was no significant change in major bleeding, with an IR of 2.59 in both cohorts, resulting in a crude IRR of 1.00; 95% CI, 0.92–1.09 (Table 3). The results were similar for all secondary bleeding end points, except hospitalized bleeding rates which had decreased in 2017 (Table 3). Stratified analyses showed no differences between age-groups (Figure 1A) or CHA_2DS_2-VASc scores (Figure 1B).

The stroke reduction was most pronounced in patients with the largest relative increase of OAC treatment (ie, with HAS-BLED 3+ and increasing with the CHA_2DS_2-VASc score; Figure 2). The rates of major bleeds were high in these high-risk individuals but did not increase over the years.

Association Between Treatment and Ischemic Stroke and Major Bleeding

The crude IRR for ischemic stroke comparing the 2 cohorts was 0.58 (95% CI, 0.52–0.65; Table 4). Adding the CHA_2DS_2-VASc score into the model resulted in an IRR of 0.63 (95% CI, 0.58–0.69). Adjusting for OAC treatment resulted in an IRR of 0.73 (95% CI, 0.66–0.80), indicating that an absolute 10% reduction of ischemic strokes was associated with the increased OAC treatment.

The crude IRR for major bleeding comparing the 2 cohorts was 1.00 (95% CI, 0.92–1.09). Further adjustments did not result in any significant changes regarding major bleeding rates (Table 4).

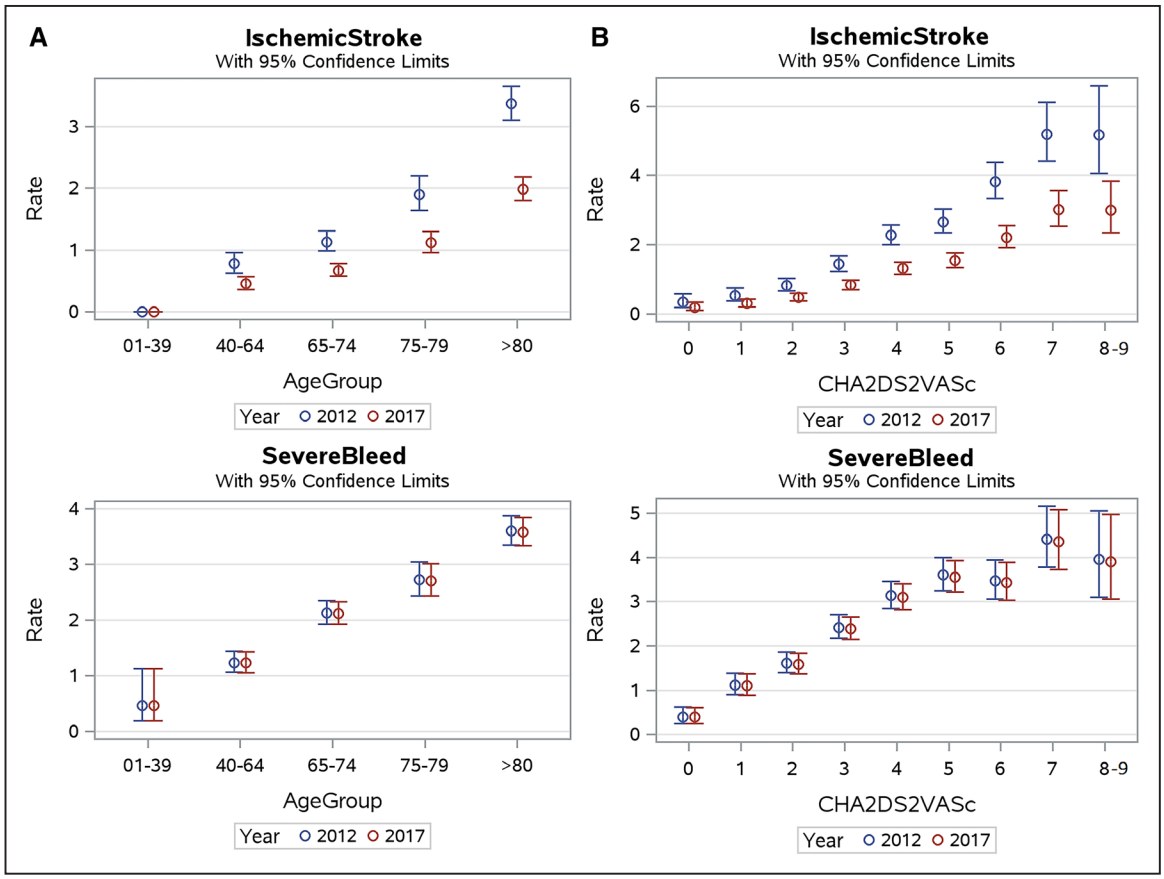

Figure 1. Incidence rates of ischemic stroke and major bleeding in 2012 and 2017, stratified by: (**A**) age group and (**B**) CHA_2DS_2-VASc score (congestive heart failure, hypertension, age ≥75 years, diabetes mellitus, stroke or TIA or thromboembolism, vascular disease, age 65–74 years, sex category).

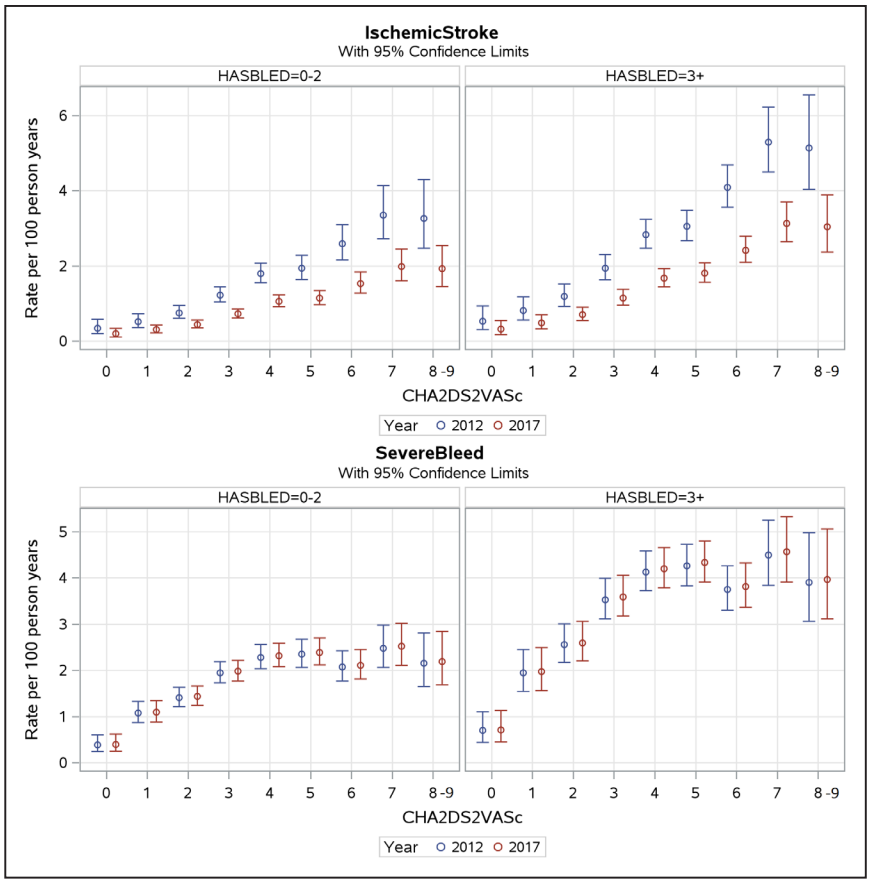

Figure 2. Incidence rates of ischemic stroke and major bleeding in 2012 and 2017, stratified by CHA_2DS_2-VASc (congestive heart failure, hypertension, age ≥75 years, diabetes mellitus, stroke or TIA or thromboembolism, vascular disease, age 65–74 years, sex category) and HAS-BLED score (hypertension, abnormal renal and liver function, stroke, bleeding, labile INR, elderly, drugs or alcohol).

Comparisons of prevalent treatment with NOAC or warfarin revealed similar rates of ischemic stroke in 2017 after adjustment for the CHA_2DS_2-VASc score: NOAC versus warfarin IRR, 0.89; 95% CI, 0.71–1.11. The rate of severe bleeding after adjustment for the HAS-BLED score was lower with NOAC: IRR, 0.74; 95% CI, 0.65–0.85. The results were similar in patients with a high risk for both stroke and bleeding (Figure II in the online-only Data Supplement).

Discussion

In this population-based comparative cohort study, we compared antithrombotic treatment patterns and clinical outcomes among patients with nonvalvular AF in an entire healthcare region with >2 million inhabitants. We found a considerable increase in the number of patients with AF. In the 2017 cohort, AF patients received OACs, in particular NOACs, much more frequently, whereas ASA treatment decreased correspondingly compared with the 2012 cohort. NOAC use increased from 1% to 47% of OAC treated patients, and ASA monotherapy decreased from 31.7% to 10.3%. This is in line with international, as well as Swedish Guidelines.[16–18] The largest increases in OAC treatment were seen among potentially frail patients with high stroke risk and a simultaneously high bleeding risk. The changed treatment pattern was associated with a lower IR for ischemic stroke. Bleeding rates remained unchanged, and this was consistent throughout age groups and at different levels of baseline stroke and bleeding risks. All effectiveness outcomes occurred less frequently in 2017, whereas none of the bleeding outcomes increased.

Poisson regression models indicated that the increase in the proportion of patients treated with OACs played a significant role in the reduction of stroke incidence. Adjusting for age, sex, and CHA_2DS_2-VASc scores influenced the IRRs little, because of comparable characteristics of the populations in the 2 cohorts. Adjusting for OAC treatment provided an explanation for 10% of the absolute reduction in ischemic stroke.

Table 4. IR and IRRs With 95% CIs for Ischemic Stroke and Major Bleeding

	2012	2017	Calculated IRR (95% CI)			
	IR	IR	Crude	Adjusted for Age Group and Sex	Adjusted for CHA_2DS_2-VASc or HAS-BLED Score	Adjusted for CHA_2DS_2-VASc or HAS-BLED Score and OAC Treatment
Ischemic stroke	2.01	1.18	0.58 (0.52–0.65)	0.64 (0.58–0.70)	0.63 (0.58–0.69)	0.73 (0.66–0.80)
Major bleeding	2.59	2.59	1.00 (0.92–1.09)	0.99 (0.91–1.08)	1.04 (0.95–1.13)	0.99 (0.91–1.08)

CHA_2DS_2-VASc indicates congestive heart failure, hypertension, age ≥75 years, diabetes mellitus, stroke or TIA or thromboembolism, vascular disease, age 65-74 years, sex category; HAS-BLED, hypertension, abnormal renal and liver function, stroke, bleeding, labile INR, elderly, drugs or alcohol; IR, incidence rate per 100 person-years; IRR, incidence rate ratio; and OAC, oral anticoagulant.

This is consistent with results from randomized trials,[4,5,22] given the observed 22.2% absolute increase in OAC treated patients and a corresponding decrease of ASA treatment.

Comparison of NOAC or warfarin in 2017 indicates advantages with NOAC treatment, consistent with results from clinical trials.[10–12] The risk of ischemic stroke was similar to the comparison in our previous observational study, which only included new initiations in previously OAC naïve AF patients,[14] but bleeding rates were more favorable in the prevalent NOAC users of the present study. These results add to the knowledge that NOACs can be used in a beneficial and safe way in frail and elderly AF patients.

After adjustment for OAC treatment, an absolute decrease in ischemic stroke of ≈27% remained unexplained. An important factor could be the growing AF population as the increased awareness of AF with earlier detection of patients with a low AF burden might explain part of the observed decrease in the risk for ischemic stroke.[27,28] Other explanations could be a better quality of anticoagulation with NOACs, but more switches or persistence to OAC treatment might also contribute (Table II in the online-only Data Supplement). In the total population of the Stockholm region, there was a 21% reduction of ischemic strokes (mainly non-AF related) between 2012 and 2017, with the largest reductions seen among the elderly (Figure III in the online-only Data Supplement). Potential explanations for this general improvement in stroke incidence could be an overall healthier population, with lower blood pressure levels, healthier lifestyles, and better managed preventive drug treatment in the elderly.[29,30]

Both the American and European guidelines for stroke prevention in AF emphasize the value of increased OAC treatment,[16,18] and the European guidelines have abandoned the use of bleeding risk scores to withhold OAC treatment.[16] Presently, the treatment goal recommended by the Swedish national board of health and welfare is to treat at least 80% of the AF patients with an OAC when a clear indication (eg, CHADS-VASc ≥2) is present.[17] In the 2017 cohort, this goal was essentially reached, with 78.9% of patients with CHA_2DS_2-VASc scores 2 to 9 being treated. Yet, in selected patients, OACs may not be indicated, despite a high risk of stroke, and the optimal proportion of AF patients gaining a net benefit from OAC treatment remains unknown. However, our findings clearly demonstrate the clinical effectiveness and safety of achieving at least 80% on OAC treatment. In fact, the greatest stroke reduction associated with OAC use was seen in those patients with the highest stroke and bleeding risks, who in previous years often were left untreated or received less effective treatment with ASA.

Our study has some limitations. First, some diagnoses might be missing in the healthcare records. This might yield slight underestimation of stroke risks evaluated by the CHA_2DS_2-VASc score, as well as of both safety and effectiveness outcomes. However, we have data also from primary care which increases the availability of comorbidities used for CHA_2DS_2-VASc scoring,[7] and they were similar in the 2 cohorts. Therefore, we do not think this has biased the results. Second, we did not include stopping or switching treatment strategy in our main analysis. To address this, we conducted additional analyses, which indicated an increased persistence and a larger portion of untreated patients switching to OAC treatment in later years (Table II in the online-only Data Supplement). Using a 6-month time interval to define OAC exposure yielded almost identical results. Because the main aim of the present study was not to compare the effectiveness of different antithrombotic treatments, we think the exposure definitions were sufficient.

One major strength of this study lies in the data used. The Vårdanalysdatabasen database contains *International Classification of Diseases Tenth Revision* codes for diagnoses and procedures from both primary and secondary care, as well as other data which provide comprehensive information about the patient. Previous work has investigated the value of primary care records for risk stratification,[7] and 14% of the AF patients in the present cohorts could only be identified in primary care records. Second, we have contributed to the difficult but clinically important question of whether or not to treat frail and elderly patients with OACs. Further research is, however, needed to address the question which OAC treatment is best for the frail and elderly and to better characterize high-risk populations, in whom withholding OAC treatment should be the preferred strategy. The large reduction of ischemic stroke within and outside of the AF population also merits further exploration.

In conclusion, increasing OAC treatment because of the availability of NOACs in a complete, nonselected population of patients with nonvalvular AF was associated with a marked reduction of ischemic stroke, although bleeding rates remained similar. The greatest clinical improvements were seen among elderly patients with elevated risks for both stroke and bleeding. These findings strongly support the adoption of current guideline recommendations for stroke prevention in AF in both primary and secondary care.

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Disclosures

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