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CLINICAL RESEARCH

Contemporary management of atrial fibrillation in primary and secondary care in the UK: the prospective long-term AF-GEN-UK Registry

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Aims This study established a prospective registry of contemporary management of UK patients with atrial fibrillation (AF) by cardiologists, general practitioners, and stroke, acute, and emergency medicine physicians at baseline and 1-year follow-up.

Methods and results Data on patients with recently diagnosed AF (≤12 months) were collected from medical records from 101 UK sites to permit comparison of patient characteristics and treatments between specialities. The impact of guideline-adherent oral anticoagulation (OAC) use on outcomes was assessed using Cox regression analysis. One thousand five hundred and ninety-five AF patients [mean (standard deviation) age 70.5 (11.2) years; 60.1% male; 97.4% white] were recruited in June 2017–June 2018 and followed up for 1 year. Overall OAC prescription rates were 84.2% at baseline and 87.1% at 1 year, with non-vitamin K antagonist oral anticoagulants (NOACs) predominating (74.9 and 79.2% at baseline and 1 year, respectively). Vitamin K antagonist prescription was significantly higher in primary care, with NOAC prescription higher among stroke physicians. Guideline-adherent OAC (CHA_2DS_2-VASc ≥2) at baseline significantly reduced risk of death and stroke at 1 year [adjusted hazard ratio (95% confidence interval): 0.48 (0.27–0.84) and 0.11 (0.02–0.48), respectively]. Rhythm control is evident in ∼25%; only 1.6% received catheter ablation.

Conclusion High OAC use (>80%, mainly NOACs) rates varied by speciality, with VKA prescription higher in primary care. Guideline-adherent OAC therapy at baseline was associated with significant reduction in death and stroke at 1 year, regardless of speciality. Rhythm-control management is evident in only one-quarter despite AF symptoms reported in 56.6%. This registry extends the knowledge of contemporary AF management outside cardiology and demonstrates good implementation of clinical guidelines for the management of AF, particularly for stroke prevention.

Keywords Atrial fibrillation • Management • Primary care • Secondary care • Registry

Introduction

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia, occurring in 2–4%[1] of the general population, with a 1-in-3 life-time prevalence.[2] Approximately 8 million Europeans aged 65 years and older suffer from this arrhythmia, and its prevalence is estimated to at least double in the next 40 years as the population ages.[2] In the UK, an analysis of the Clinical Practice Research Datalink from 1998 to 2010 demonstrated ongoing increases in incident AF particularly among those aged 75 years and older, with a projected prevalence of AF from 700 000 patients in 2010 to 1.3–1.8 million by 2060.[3]

Management strategies for AF have made many advances over the last decade.[2] Broadly, they can be discussed in relation to strategies of thromboprophylaxis, rate and/or rhythm control, and the management of associated cardiovascular and other comorbidities. More recently, this has been operationalized as the Atrial fibrillation Better Care pathway[4] and incorporated into the latest guidelines on the management of AF.[2,5] 'A' focuses on the avoidance of stroke. Clearly, stroke

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What's new?

- Prospective registry of contemporary management of 1595 UK patients with atrial fibrillation (AF) by cardiologists, general practitioners, and stroke, acute, and emergency medicine physicians at baseline and 1-year follow-up.
- High oral anticoagulation (OAC) prescription rate (>80%, mainly non-vitamin K antagonist oral anticoagulants) but varied by speciality, with vitamin K antagonist prescription higher in primary care.
- Guideline-adherent OAC (CHA_2DS_2-VASc ≥2) at baseline significantly reduced risk of death and stroke at 1 year.
- Rhythm control is evident in approximately one-quarter despite AF symptoms reported in 57%, with only 1.6% receiving catheter ablation.

prevention has greatly improved with oral anticoagulation (OAC) and the introduction of the non-vitamin K antagonist oral anticoagulants (NOACs) that have overcome many of the limitations of warfarin, resulting in greater utilization of OAC for stroke prevention in AF.[6–10] The approach to rate and rhythm control has also become more symptom-directed and patient-centred to alleviate symptoms and improve quality of life[2,11] and may involve a combination of rate-control and anti-arrhythmic drugs, cardioversion, and catheter ablation. Given that AF coexists with various comorbidities and structural heart disease, these also need to be proactively managed as part of the holistic approach to AF management.[2,12,13]

Despite the evidence from epidemiology, clinical trials, and guidelines, there is still great heterogeneity in the management of patients with AF, although guideline-adherent therapy improves outcomes.[14–16] Despite the availability of guidelines, it remains unclear how often clinicians adhere to them, and there is often a lag period between the publishing of new clinical guidelines and their widespread implementation. Hence, there is a need for the systematic collection of contemporary data regarding the management and treatment of AF in 'real-world' clinical practice.

The EURObservational Research Programme (EORP) was established in 2012 to pilot a registry to collect data on the current management of AF patients across Europe to provide a contemporary update to the Euro Heart survey,[17–19] given the significant changes in the management strategies influenced not only by clinical availability of catheter ablation as a routine procedure and new anti-arrhythmic drugs, but also by developments in stroke thromboprophylaxis and medical therapy options. The EORP pilot general registry enrolled 3119 patients between February 2012 and March 2013 across nine European countries.[20] Following this, the EORP-AF Long-Term General (AF-GEN) Registry captured data on the management of AF by cardiologists between 2013 and 2016, enrolling 11 096 patients from 250 centres in 27 European countries.[7]

Following completion of the AF-GEN study, recruitment was extended in the UK to general practice and other specialities (stroke medicine, acute medicine, and emergency medicine). The present study (AF-GEN-UK) reports the findings on the management of AF patients managed by cardiology and non-cardiology specialities and compares the management of AF patients between specialities to provide a unique insight and more detailed information on the utilization of NOACs outside of cardiology.

Methods

The AF-GEN-UK is an extension of the EORP Long-Term Registry on patients with AF (AF-GEN) in the UK. This is an observational, multicentre, prospective cohort study of AF managed in both primary and secondary care in the UK. The registry established a 'snapshot' survey of the contemporary diagnosis and management of patients with AF amongst cardiologists, general practitioners (GPs), stroke physicians, acute medicine, and emergency medicine physicians in the UK at the time of enrolment, and changes over a 12-month period. No specific treatment was mandated, and treatment choices were made according to local practice and at the discretion of the treating physician.

Inclusion and exclusion criteria

Patients were eligible for enrolment if AF diagnosis was documented by electrocardiogram (ECG) (12-lead, Holter recording, external event recorder, or implantable loop recorder), and they met the following criteria: (i) aged ≥18 years at enrolment; (ii) qualifying episode of AF occurred within 1 year before the date of baseline; (iii) AF was the primary or secondary diagnosis, i.e. the admission/visit may have been due to other reasons; (iv) patients did not need to be in AF at the time of enrolment; and (v) patient (or legally acceptable representative) willing and able to provide written informed consent. Patients were excluded from participation if (i) no ECG/Holter with AF recorded was documented and available; (ii) only atrial flutter was recorded; (iii) the qualifying episode of AF occurred more than 1 year before the date of baseline; and (iv) women of childbearing potential.

Study procedure

Participants were consecutively enrolled from 101 sites, including 43 hospitals across the UK (40 in England, 1 in Wales, 1 in Scotland, and 1 in Northern Ireland) and 58 general practices in England, during a 12-month recruitment period (June 2017–June 2018).

The following information was obtained at baseline using an electronic case report form: (i) demographic data including date of birth, gender, weight, height (calculated BMI), and ethnicity; (ii) past medical history (to enable calculation of the CHA_2DS_2-VASc and HAS-BLED scores); (iii) information regarding AF (duration, type, symptoms, etc.); (iv) investigations and procedures (blood tests, echocardiography, electrophysiological study, etc.); (v) treatments for AF including electrical or pharmacological cardioversion, catheter ablation, surgical therapy, pacemaker, cardiac resychronization therapy, implantable cardiac defibrillator, and other cardiovascular interventions; (vi) medication including current antithrombotic therapy; and (vii) discharge (from hospital or current status) including management strategy. Patient's quality of life was assessed using the EQ-5D questionnaire[21] at baseline and 12-months follow-up.

Outcomes

The outcome variables of interest were adherence to the 2016 European Society of Cardiology (ESC) guidelines on the management of AF patients in relation to anticoagulation therapy and rate- and/or rhythm-control strategies at baseline (current guidelines at the time of data collection). Maintenance and/or changes to therapy (antithrombotic therapy and rhythm-control) over the 12-month follow-up period were noted. Patients vital status at 12 months was recorded. Cause of death was determined (where possible by the site) and classified as cardiovascular, non-cardiovascular, or unknown. In addition, the 12-month incidence of thromboembolism [ischaemic stroke, transient ischaemic attack (TIA), pulmonary embolism, and deep vein thrombosis (DVT)], major bleeding (including intracranial), and acute coronary syndrome were recorded. Follow-up was undertaken at a routine patient visit and/or chart review and/or telephone follow-up with the patient or their GP, depending on the local healthcare practice.

The study was conducted in accordance with International Society for Pharmacoepidemiology Guidelines for Good Pharmacoepidemiology Practices and applicable regulatory requirements. The study received ethical approval from the West Midlands Research Ethics Committee (17/WM/0013) and other regulatory approvals. All patients provided written informed consent.

All clinical data were captured via a web-based electronic data capture system managed by the ESC. The site staff entered and edited the data via a secure network, with secure access features (username, password, and secure identification—an electronic password system). Each patient was given a unique patient identification number. The site research team made a separate confidential record of these details (patient identification

code list) to permit identification of all patients enrolled to allow for follow-up.

Data analysis

The distribution of the continuous variables was assessed by the Kolmogorov–Smirnov test and histogram visualization. Continuous variables were reported as means and standard deviations (SDs). Normally distributed data were compared using an ANOVA test. Categorical variables are reported as counts and percentages and were compared using the χ^2 test. The prevalence of the outcomes of interest were calculated as percentage. Any missing values were labelled as missing with no additional statistical tests performed to account for missing data. The multivariate Cox regression analysis was conducted to assess the impact of guideline-adherent OAC use on outcomes. The model was adjusted for age, gender, OAC use, and CHA_2DS_2-VASc score. Unadjusted and adjusted hazard ratios (HRs) and 95% confidence intervals (CIs) were reported. The Kaplan–Meier curve for all-cause death and ischaemic stroke by guideline-adherent OAC use was constructed. A two-tailed *P*-value of <0.05 was considered statistically significant. All analyses were performed using STATA statistical software, version 13 (STATA Inc., USA).

Results

During the 12-month recruitment period, 1602 patients were enrolled into the AF-GEN-UK across 101 sites, with 1595 (99.3%) included in the present analyses. Seven patients were not included due to withdrawal of consent. Most patients enrolled were managed by cardiologists (62.5%), 158 (9.9%) by stroke physicians, 184 (11.5%) by acute or emergency medicine physicians, and 256 (16.1%) by GPs. The overall mean (SD) age of the cohort was 70.5 (11.2) years, 60.1% were male, and the majority (97.4%) were of white ethnicity (*Table 1*). The patients managed by cardiologists were significantly younger than patients managed by the other specialities. The proportion of patients aged ≥75 years was significantly higher among those managed by non-cardiologists, being highest among those managed by stroke physicians (52.5%). Hypertension was the most common comorbidity at enrolment occurring in 71.6%, with a significantly higher proportion among those patients managed by stroke physicians (88.7%). Diabetes mellitus, heart failure, coronary heart disease, and valvular heart disease were present in approximately one-fifth of patients, and 14.3% had experienced a previous ischaemic stroke or TIA. The overall mean (SD) CHA_2DS_2-VASc score at enrolment was 2.8 (1.7) and 1294 (81.1%) had ≥2 long-term conditions (multimorbidity), of which one was AF.

Overall 43.3% of the cohort were newly diagnosed with AF, although this proportion differed significantly across the medical specialities and was highest among those managed by stroke (74.5%) and acute or emergency medicine (70.3%) physicians, likely due to the higher proportion of recruitment from inpatients in these two groups. Significantly more patients managed by primary care physicians had permanent AF compared with those managed by other medical specialities (*Table 1*). Eight hundred and eighty-six (55.5%) of the cohort were symptomatic, with two-thirds classed as European Heart Rhythm Association (EHRA) Class II (normal daily activity not affected but patient aware of symptoms). There was no significant difference in the proportions of symptomatic patients across the specialities but primary care patients were less likely to report EHRA Class III or IV symptoms.

Antithrombotic therapy use

At enrolment, data on antithrombotic therapy were available in 1591 (99.7%), with 1339 (84.2%) patients receiving OAC, 225 (14.2%) receiving antiplatelets (mono- or dual therapy), 150 (9.4%) on combination OAC and antiplatelet therapy, and 177 (11.1%) not receiving any antithrombotic therapy (*Table 2* and *Figure 1*). Based on the 2016 ESC guidelines, 1236 (77.8%) were receiving guideline-adherent stroke prevention at baseline (OAC for men with a CHA_2DS_2-VASc score of ≥1 and women with a CHA_2DS_2-VASc score of ≥2), with 1093 (68.8%) receiving an NOAC (see Supplementary material online, *Table S1* and *Figure S1*). One hundred and one (6.4%) patients were receiving non-guideline-adherent OAC therapy (CHA_2DS_2-VASc score 0 or 1 in men and 1 in women), but it is possible that some of these patients were awaiting or had recently received cardioversion or ablation and hence OAC treatment was appropriate at that time. Among those receiving an NOAC, most (41.6%) were on apixaban; analogous figures for rivaroxaban, edoxaban, and dabigatran were 26.4, 4.3, and 2.6%, respectively (*Table 2*).

At the 12-month follow-up, information on antithrombotic therapy was available in 1314 of 1319 (99.6%) patients. The proportion of patients receiving OAC had increased to 87.1% (*Table 2*), with 1073 (81.8%) receiving guideline-adherent stroke prevention (OAC for those with a CHA_2DS_2-VASc score of ≥2 and men with CHA_2DS_2-VASc score of 1) (see Supplementary material online, *Table S1* and *Figure S1*), and most (970/1073, 90.4%) receiving an NOAC. Apixaban was the most widely prescribed NOAC at 12 months (43.2%) (*Table 2* and Supplementary material online, *Table S1*). Only 88 (6.7%) patients were receiving antiplatelet therapy (mono- or dual), 60 (4.6%) were receiving combination OAC and antiplatelets, and 142 (10.8%) were not receiving any antithrombotic therapy at 1 year (*Table 2*).

Antithrombotic therapy by speciality

Table 2 and *Figure 1* report antithrombotic therapy by speciality. At baseline, OAC use was 75% or more in all specialities, and highest among those patients enrolled from primary care (88.3%) followed by cardiologists (85.1%), stroke physicians (80.9%), and acute/emergency medicine (76.1%) (*Figure 2*). The prescription of NOAC was significantly lower among primary care physicians compared with patients managed by other specialists (*Table 2*). At the 12-month follow-up, the proportion of patients receiving OAC had increased (87.1% overall). Non-vitamin K antagonist oral anticoagulant use in primary care-managed patients increased from 67.6 to 74.6%, but VKA was still significantly more likely to be prescribed by primary care physicians compared with secondary care (*Table 2* and *Figures 1* and *2*). Most patients on OAC at 12 months were receiving an NOAC (79.2%); the highest proportion of patients receiving an NOAC were managed by stroke physicians (*Table 2* and *Figures 1* and *2*).

Atrial fibrillation-related symptoms and rhythm-control strategies

Rhythm management with either cardioversion or catheter ablation was evident at enrolment in only approximately one-quarter (26.1%) of patients (*Table 3* and Supplementary material online, *Figure S2*). Electrical cardioversion was the most commonly employed rhythm-control strategy (19.6%), with only 1.6% overall receiving catheter ablation. The use of rhythm-control interventions varied significantly by the type of AF. Previous electrical cardioversion was significantly higher among those with persistent AF (data not shown). Pharmacological cardioversion was used more commonly in those with first diagnosed AF, with catheter ablation used most often in those with paroxysmal AF (data not shown). Catheter ablation was only evident in patients managed by cardiologists or acute and emergency medicine physicians, and pharmacological cardioversion was significantly more common in patients managed by acute or emergency medicine physicians. Amiodarone was the most common anti-arrhythmic drug prescribed (4.8%) and significantly more likely to be used in those with first diagnosed, paroxysmal AF, or persistent AF and was rarely used in patients enrolled by primary care (data not shown). Flecainide was only used in 1.3%, with other anti-arrhythmic drugs used in only a few patients (*Table 3*).

Table 1 Demographic and clinical characteristics of participants at the time of enrolment overall and by medical speciality

Variables Mean (SD), *n* (%)	Total cohort (*n* = 1595)	Cardiology (*n* = 997)	Stroke (*n* = 158)	Acute and emergency medicine (*n* = 184)	Primary care (*n* = 256)	*P*-value
Age, years	70.5 (11.2)	69.0 (11.3)	74.3 (9.8)	71.5 (12.2)	73.4 (9.7)	**<0.001**
<65	412 (25.8)	308 (30.9)	23 (14.6)	44 (29.3)	37 (14.5)	**<0.001**
65–74	572 (35.9)	363 (36.4)	52 (32.9)	59 (32.1)	98 (38.3)	
≥75	611 (38.3)	326 (32.7)	83 (52.5)	81 (44.0)	121 (47.3)	
Male	958 (60.1)	603 (60.5)	96 (60.8)	92 (50.0)	167 (65.2)	**0.01**
Ethnicity						0.20
White	1553 (97.4)	971 (97.4)	156 (98.7)	175 (95.1)	251 (98.1)	
Black	9 (0.6)	5 (0.5)	0	2 (1.1)	2 (0.8)	
South Asian	12 (0.8)	10 (1.0)	0	1 (0.5)	1 (0.4)	
Other	6 (0.4)	2 (0.2)	0	3 (1.6)	1 (0.4)	
Unknown	15 (0.9)	9 (0.9)	2 (1.3)	3 (1.6)	1 (0.4)	
Type of AF (*n* = 1580)						**<0.001**
First diagnosed	684 (43.3)	396 (40.2)	117 (74.5)	128 (70.3)	43 (16.9)	
Paroxysmal	271 (17.2)	189 (19.2)	16 (10.2)	24 (13.2)	42 (16.5)	
Persistent	419 (26.5)	347 (35.2)	7 (4.5)	27 (14.8)	38 (14.9)	
Permanent	206 (13.0)	54 (5.5)	17 (10.8)	3 (1.7)	132 (51.8)	
EHRA score (*n* = 1592)						**<0.001**
EHRA I	706 (44.4)	384 (38.6)	128 (81.5)	56 (30.4)	138 (53.9)	
EHRA II	600 (37.7)	400 (40.2)	21 (13.4)	87 (47.3)	92 (35.9)	
EHRA III	257 (16.1)	190 (19.1)	7 (4.5)	35 (19.0)	25 (9.8)	
EHRA IV	29 (1.8)	21 (2.1)	1 (0.6)	6 (3.3)	1 (0.4)	
Past medical history, *n* (%)						
Hypertension (*n* = 1028)	736 (71.6)	431 (67.2)	102 (88.7)	71 (68.3)	132 (78.6)	**<0.001**
Diabetes (*n* = 1586)	303 (19.1)	166 (16.8)	39 (25.0)	32 (17.4)	66 (25.8)	0.14
Heart failure (*n* = 1543)	292 (18.9)	210 (21.8)	12 (8.0)	32 (17.8)	38 (15.2)	**<0.001**
Coronary artery disease (*n* = 1508)	308 (20.4)	191 (20.7)	38 (24.7)	33 (18.2)	46 (18.6)	0.42
Peripheral vascular disease (*n* = 1572)	50 (3.2)	22 (2.2)	6 (3.9)	9 (5.0)	13 (5.1)	**0.046**
Previous thromboembolic events (*n* = 1564)	265 (16.9)	105 (10.8)	107 (68.2)	25 (13.8)	28 (11.0)	**<0.001**
CHA_2DS_2-VASc score (*n* = 1591)	2.8 (1.7)	2.6 (1.6)	4.3 (1.6)	2.9 (1.5)	2.9 (1.5)	**<0.001**
0	116 (7.3)	94 (9.4)	0	12 (6.5)	10 (3.9)	
1	243 (15.3)	177 (17.8)	4 (2.6)	30 (16.3)	32 (12.6)	
2	325 (20.4)	227 (22.8)	18 (11.5)	27 (14.7)	53 (20.8)	
3	379 (23.8)	219 (22.0)	30 (19.2)	51 (27.7)	79 (31.0)	
4	294 (18.5)	168 (16.9)	35 (22.4)	42 (22.8)	49 (19.2)	
5	133 (8.4)	69 (6.9)	31 (19.9)	14 (7.6)	19 (7.5)	
6	65 (4.1)	30 (3.0)	22 (14.1)	6 (3.3)	7 (2.8)	
≥7	36 (2.3)	12 (1.2)	16 (10.1)	2 (1.1)	6 (2.3)	
HAS-BLED score (*n* = 1593), mean (SD)	1.5 (1.0)	1.4 (0.9)	2.3 (1.0)	1.6 (1.0)	1.7 (1.0)	**<0.001**

Values in bold indicate *P* values <0.05.
AF, atrial fibrillation; CHA_2DS_2-VASc, stroke risk score; EHRA, European Heart Rhythm Association; HAS-BLED, bleeding risk score; SD, standard deviation.

Clinical outcomes during follow-up

The 12-month follow-up assessment was completed in 1319 (82.7%). Of those without 12-month follow-up, vital status only was available in 219 (13.7%) patients. Thirteen (0.8%) patients withdrew consent for follow-up and 44 (2.8%) were lost to follow-up. In the first 12-months of follow-up, 75 patients (4.9%) died (*Table 4*); cardiovascular disease was the cause of death in 23 (30.1%) patients, non-cardiovascular in 29 (38.7%), and unknown in 23 (31.5%) patients. Nineteen (1.4%) experienced a thromboembolic event, of which seven (0.5%) were ischaemic strokes, eight (0.6%) TIAs, and four (0.3%) were

Table 2 Antithrombotic medication use by medical specialty at baseline and 1-year follow-up

Medications, *n* (%)	Total cohort (*n* = 1595)	Cardiology (*n* = 997)	Stroke (*n* = 158)	Acute and AE (*n* = 184)	Primary care (*n* = 256)	*P*-value
Antithrombotic therapy at baseline						
Antiplatelet therapy at baseline (*n* = 1590)						**<0.001**
None	1365 (85.9)	862 (86.7)	118 (75.2)	155 (84.2)	230 (90.2)	
Aspirin alone	131 (8.2)	65 (6.6)	25 (15.9)	22 (12.0)	19 (7.4)	
Other monotherapy	52 (3.3)	32 (3.2)	9 (5.7)	5 (2.7)	6 (2.4)	
Dual antiplatelets	42 (2.6)	35 (3.5)	5 (3.2)	2 (1.1)	0	
Oral anticoagulant at baseline (*n* = 1591)	1339 (84.2)	846 (85.1)	127 (80.9)	140 (76.1)	226 (88.3)	**0.003**
VKA	148 (9.3)	82 (8.3)	4 (2.6)	9 (4.9)	53 (20.7)	**<0.001**
NOAC	1191 (74.9)	764 (76.8)	123 (78.3)	131 (71.2)	173 (67.6)	
Apixaban (*n* = 1590)	661 (41.6)	397 (40.0)	94 (59.9)	83 (45.1)	87 (34.0)	**<0.001**
Dabigatran	42 (2.6)	34 (3.4)	2 (1.3)	0	6 (2.3)	**0.04**
Edoxaban	69 (4.3)	39 (3.9)	8 (5.1)	8 (4.4)	14 (5.5)	0.70
Rivaroxaban	419 (26.4)	294 (29.6)	19 (12.1)	40 (21.7)	66 (25.8)	**<0.001**
No antithrombotic at baseline (*n* = 1590)	177 (11.1)	106 (10.7)	12 (7.6)	34 (18.5)	25 (9.8)	**0.005**
Antithrombotic therapy at baseline (OAC or antiplatelet) (*n* = 1590)	1413 (88.9)	888 (89.3)	145 (92.4)	150 (81.5)	230 (90.2)	**0.005**
Antithrombotic therapy (OAC and antiplatelet) (*n* = 1590)	150 (9.4)	90 (9.1)	21 (13.4)	19 (10.3)	20 (7.8)	**0.003**
Antithrombotic therapy at 1-year follow-up						
Antiplatelet therapy at 1 year (*n* = 1314)						
None	1226 (93.3)	766 (92.6)	126 (96.2)	123 (93.2)	211 (94.2)	0.82
Aspirin alone	45 (3.4)	30 (3.6)	2 (1.5)	5 (3.8)	8 (3.6)	
Other monotherapy	35 (2.7)	24 (2.9)	3 (2.3)	3 (2.3)	5 (2.2)	
Dual antiplatelets	8 (0.6)	7 (0.9)	0	1 (0.8)	0	
Oral anticoagulant at 1-year follow-up (*n* = 1314)	1144 (87.1)	705 (85.3)	128 (97.7)	107 (81.1)	204 (91.1)	**<0.001**
VKA	104 (7.9)	56 (6.8)	7 (5.3)	4 (3.0)	37 (16.5)	**<0.001**
NOAC	1040 (79.2)	649 (78.5)	121 (92.4)	103 (78.1)	167 (74.6)	
Apixaban (*n* = 1312)	567 (43.2)	333 (40.3)	87 (66.9)	61 (46.2)	86 (38.4)	**<0.001**
Dabigatran (*n* = 1313)	42 (3.2)	34 (4.2)	2 (1.5)	1 (0.8)	5 (2.2)	0.08
Edoxaban	71 (5.4)	41 (5.0)	10 (7.6)	6 (4.6)	14 (6.3)	0.55
Rivaroxaban	360 (27.4)	241 (29.1)	22 (16.8)	35 (26.5)	62 (27.7)	**0.03**
No antithrombotic at 1 year (*n* = 1314)	142 (10.8)	100 (12.1)	2 (1.5)	21 (15.9)	19 (8.5)	**<0.001**
Antithrombotic therapy at 1 year (OAC or antiplatelet) (*n* = 1314)	1172 (89.2)	727 (87.9)	129 (98.5)	111 (84.1)	205 (91.5)	**<0.001**
Antithrombotic therapy at 1 year (OAC and antiplatelet) (*n* = 1314)	60 (4.6)	39 (4.7)	4 (3.1)	5 (3.8)	12 (5.4)	**<0.001**

Values in bold indicate *P* values <0.05.
AE, accident and emergency; NOAC, non-vitamin K antagonist oral anticoagulant; OAC, oral anticoagulation; VKA; vitamin K antagonist.

pulmonary embolisms or DVT. Twenty (1.5%) patients had an acute coronary syndrome. Major bleeding occurred in 20 (1.5%) patients within 12-months, of which 6 (0.4%) were intracranial haemorrhages. There was no significant difference in the number of deaths, thromboembolic, haemorrhagic or acute coronary syndrome events between specialities. Among patients receiving OAC at baseline, only the incidence of ischaemic stroke was significantly reduced compared with those not on OAC at baseline (0.3 vs. 1.9%, $P = 0.002$). Guideline-adherent OAC use in patients with a CHA_2DS_2-VASc score ≥2 at baseline significantly reduced the risk of all-cause death [adjusted HR (aHR): 0.48, 95% CI: 0.27–0.84], ischaemic stroke (aHR: 0.11, 95% CI: 0.02–0.48) and the composite endpoint of death and stroke at 1 year (aHR: 0.41, 95% CI: 0.24–0.70) (*Table 5*). Kaplan–Meier curves demonstrate that OAC use at baseline in patients with a CHA_2DS_2-VASc score ≥2 significantly reduced the probability of all-cause death (log-rank $P = 0.004$, *Figure 3A*) and ischaemic stroke (log-rank $P = 0.0002$, *Figure 3B*).

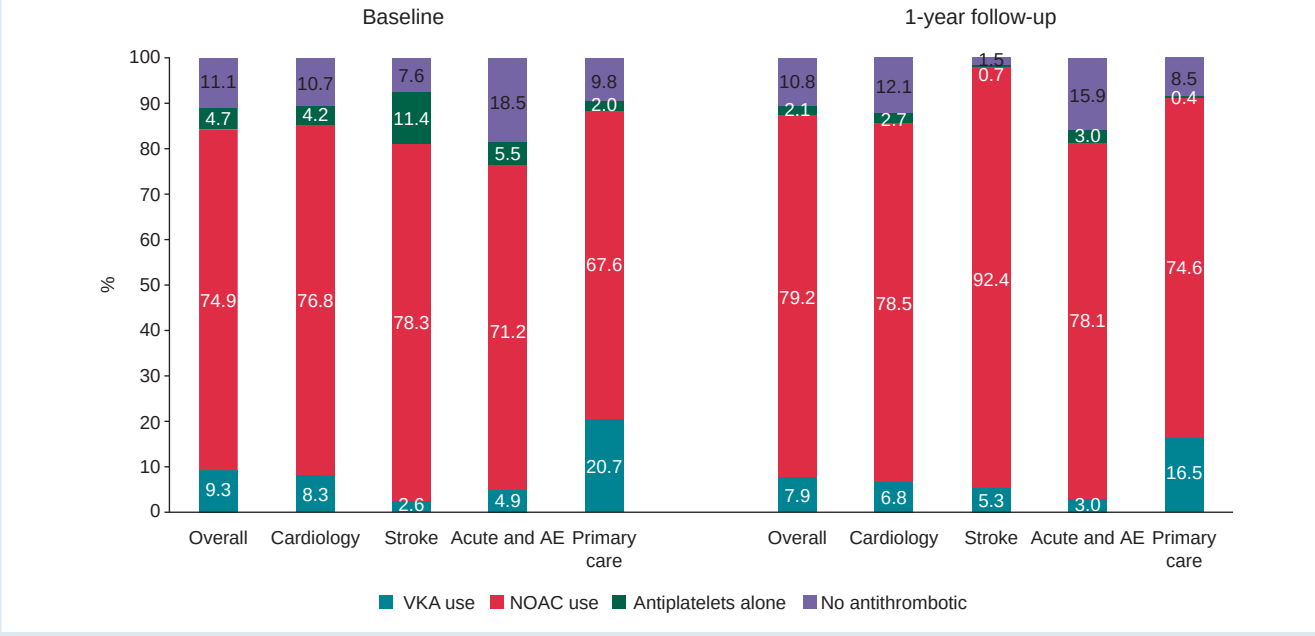

Figure 1 Antithrombotic treatment at the time of enrolment and at 1-year follow-up by speciality. AE, accident and emergency; NOAC, non-vitamin K antagonist oral anticoagulant; VKA, vitamin K antagonist. Due to rounding, the total in each column does not always sum to 100%.

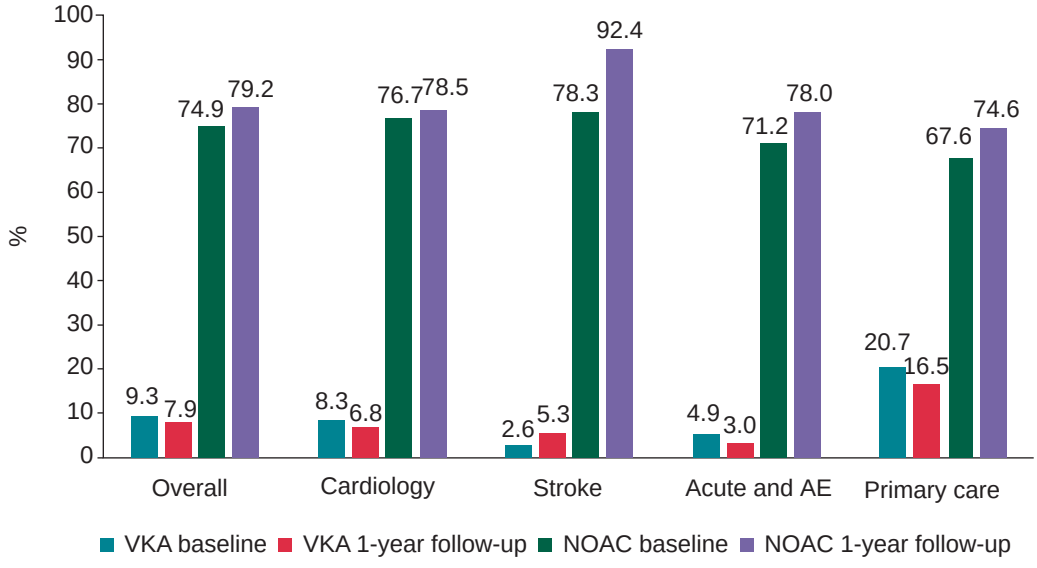

Figure 2 Use of VKA and NOAC by speciality at baseline and 1-year follow-up. AE, accident and emergency; NOAC, non-vitamin K antagonist oral anticoagulant; VKA, vitamin K antagonist.

Discussion

This registry provides a unique insight into the contemporary management of UK patients with newly diagnosed AF (within 1 year) who are managed by primary care and a range of secondary care specialities (cardiology, stroke medicine, and acute and emergency medicine), enabling a greater wealth and diversity of information on how AF patients are managed by non-cardiology specialists and permits comparison between cardiology and non-cardiology specialists.

The overall use of OAC was high (>84%) at baseline although there were differences between the specialities, with the highest proportion of OAC use evident among those managed by primary care physicians. However, the prescription of NOACs at baseline was significantly lower among those enrolled by primary care; VKAs were still used in 20.1%

Table 3 Rhythm management by medical specialty at baseline

Rhythm management, *n* (%)	Total cohort (*n* = 1595)	Cardiology (*n* = 997)	Stroke (*n* = 158)	Acute and AE (*n* = 184)	Primary care (*n* = 256)	*P*-value
Anti-arrhythmic drugs						
Amiodarone (*n* = 1589)	76 (4.8)	60 (6.0)	3 (1.9)	10 (5.5)	3 (1.2)	**0.003**
Flecainide (*n* = 1589)	20 (1.3)	18 (1.8)	0	0	2 (0.8)	0.07
Propafenone (*n* = 1589)	3 (0.2)	3 (0.3)	0	0	0	0.62
Dronedarone (*n* = 1589)	3 (0.2)	3 (0.3)	0	0	0	0.61
Quinidine (*n* = 1589)	1 (0.06)	0	0	0	1 (0.4)	0.16
Sotalol (*n* = 1589)	10 (0.6)	9 (0.9)	0	1 (0.6)	0	0.28
Rhythm management at consultation (*n* = 1592)	414 (26.0)	352 (35.4)	6 (3.8)	43 (23.4)	13 (5.1)	**<0.001**
Electrical cardioversion (*n* = 1591)	311 (19.6)	273 (27.4)	2 (1.3)	25 (13.6)	11 (4.3)	**<0.001**
Pharmacological cardioversion (*n* = 1592)	52 (3.3)	37 (3.7)	1 (0.6)	13 (7.1)	1 (0.4)	**<0.001**
Catheter ablation (*n* = 1591)	26 (1.6)	24 (2.4)	0	2 (1.1)	0	**<0.001**

Values in bold indicate *P* values <0.05.
AE, accident and emergency.

of patients at baseline. At 1-year follow-up, the proportion of patients receiving OAC had increased to 87.1%, with improvements across all groups, with the majority receiving an NOAC, predominantly apixaban; however, patients enrolled by primary care physicians were still significantly more likely to receive a VKA than patients managed by the other specialities. Guideline-adherent OAC therapy (based on 2016 recommendations current at the time of data collection), was prescribed to 78% of the cohort at baseline, rising to 82% at follow-up.

The proportion of patients receiving OAC at baseline in the present study is similar to the percentage of patients prescribed OAC in the EORP-AF Pilot[20] and General Long-term registry (AF-GEN),[7] at around 80–85%. However, the pattern of OAC prescribing has changed dramatically since 2012, with greater utilization of NOACs over time. In the EORP-AF Pilot study, 71.6% received a VKA and only 8.4% received an NOAC.[22] In the AF-GEN study,[7] 84.9% were prescribed OAC, with 40.9% receiving an NOAC, compared with the present study where 84.2% received OAC at baseline, with 74.9% prescribed an NOAC. In the AF-GEN study,[7] there was a decrease in OAC use at 1 year to 74.9%, with only 32.8% receiving an NOAC. This contrasts with the findings of the present study, where the overall prescription of OAC rose from 84.2 to 87.1% over the 1-year follow, with a corresponding rise in the use of NOACs from 74.9 to 79.2%. The differences between the proportions of patients prescribed NOACs between AF-GEN[7] and the current UK cohort may reflect the widespread availability of the NOACs in the UK compared with the restrictions on NOAC prescription previously evident in some European countries.

The use of antiplatelets has fallen dramatically over the last decade; in the EORP-AF Pilot study,[20] one-third received aspirin at baseline compared with only 7.0% in the AF-GEN study[7] and 4.7% in this UK cohort, which decreased in the latter to only 2.1% overall at 1-year follow-up. This pattern of OAC use and greater uptake of the NOACs and a corresponding decrease in antiplatelet use over time is also evident in other real-world registries; NOAC use of up to 43% in 2016 in GARFIELD-AF and 71% in ORBIT-AF II and reductions in antiplatelet use, 36 to 17% in GARFIELD-AF, and 18 to 8% in ORBIT-AF I and II.[10]

The findings from the present study are reassuring and evidence that guideline recommendations that antiplatelet therapy is not an effective stroke prevention strategy for AF patients has been implemented in the UK across the specialities. Although the uptake of NOACs is 75% or greater across all the specialities at 1 year, there is still room for improvement. First, to increase the use of OAC for all eligible patients, second to phase out the use of antiplatelet therapy for stroke prevention in AF completely, and last to increase the prescription of NOACs in primary care, where 16.5% of patients in the current cohort were still receiving a VKA.

In the 1-year follow-up of the EORP-AF Long-term registry (AF-GEN), the rate of stroke and any thromboembolic events was low, 0.7 and 1.2%, respectively. A similar low rate of stroke and thromboembolism was also evident in the current cohort, 0.5 and 1.4%, respectively. The rate of haemorrhagic events was lower in the current study compared with AF-GEN[8] (1.5 vs. 2.3%, respectively). All-cause mortality and cardiovascular death occurred in 5.2 and 3.9%, respectively, in AF-GEN.[8] Analogous figures for the present study were 4.9 and 1.5%, respectively. The AF-GEN study demonstrated that NOAC use was independently associated with a lower risk of the composite endpoint of any thromboembolism, acute coronary syndrome or cardiovascular death, and a lower risk of all-cause mortality and cardiovascular death.[8] In the present cohort, the incidence of ischaemic stroke was significantly lower among those on OAC at baseline compared with those not receiving OAC at baseline. Furthermore, patients with a CHA_2DS_2-VASc score ≥2 at baseline on OAC had a significantly lower incidence of death (all-cause, cardiovascular, and non-cardiovascular death) and ischaemic stroke compared with those with a CHA_2DS_2-VASc score ≥2 not on OAC at baseline. However, it is important to consider the possibility of confounding by indication, as 'sicker' patients may not be able to be prescribed OAC and they are more likely to die/have adverse events. Indeed, a comparison between the EORP-AF Pilot and the Euro Heart Survey AF registries found important differences in the epidemiology of AF over the 15-year period between the data collection, demonstrating an increasingly elderly AF population with greater comorbidities and a higher risk of death despite greater use of OAC.[23] These findings in combination highlight the importance of guideline-adherent OAC treatment to improve patient outcomes.

Reduction of AF symptoms via rate- and rhythm-control strategies to improve quality of life is a key component of the management of AF. Asymptomatic AF was evident in 44.4%, a similar proportion to

Table 4 Clinical outcomes at 1-year follow-up overall and by recruiting speciality

Outcomes, *n* (%)	Total cohort (*n* = 1538)[a]	Cardiology (*n* = 973)	Stroke (*n* = 149)	Acute and AE (*n* = 171)	Primary care (*n* = 245)	*P*-value
All-cause mortality	75 (4.9)	45 (4.6)	7 (4.7)	15 (8.8)	8 (3.3)	0.07
Cardiovascular death	23 (1.5)	14 (1.4)	1 (0.7)	6 (3.5)	2 (0.8)	0.12
Non-cardiovascular death	29 (1.9)	15 (1.5)	5 (3.4)	4 (2.3)	5 (2.0)	
Unknown	23 (1.5)	16 (1.6)	1 (0.7)	5 (2.9)	1 (0.4)	
Thromboembolic events (*n* = 1382)	19 (1.4)	10 (1.2)	3 (2.2)	4 (2.7)	2 (0.9)	0.34
Ischaemic stroke	7 (0.5)	4 (0.5)	1 (0.7)	1 (0.7)	1 (0.4)	0.96
Transient ischaemic attack	8 (0.6)	4 (0.5)	1 (0.7)	2 (1.4)	1 (0.4)	0.59
Pulmonary embolism/DVT	4 (0.3)	2 (0.2)	1 (0.7)	1 (0.7)	0	0.49
Haemorrhagic events (*n* = 1365)	20 (1.5)	11 (1.3)	1 (0.7)	3 (2.1)	5 (2.2)	0.58
Intracranial	6 (0.4)	4 (0.5)	0	1 (0.7)	1 (0.4)	0.85
Major extracranial	14 (1.3)	7 (0.8)	1 (0.7)	2 (1.4)	4 (1.8)	0.59
Acute coronary syndrome (*n* = 1381)	20 (1.5)	10 (1.2)	5 (3.6)	4 (2.7)	1 (0.4)	0.04

AE, accident and emergency; DVT, deep vein thrombosis.
[a]Follow-up visit was not performed in 158 patients, but 1-year vital status was known for 140 of them (all alive), and they were included into the analysis.

Table 5 Predictors of death, stroke, and combined outcome of death and stroke in the group with CHA_2DS_2-VASc score ≥2

Variables	Univariate analysis Hazard ratio (95% CI)	*P*-value	Multivariate analysis Hazard ratio (95% CI)	*P*-value
Death				
OAC use at baseline	0.45 (0.26–0.78)	**0.005**	0.48 (0.27–0.84)	**0.01**
Age	1.05 (1.02–1.08)	**0.001**	1.04 (1.01–1.07)	**0.02**
Female sex	0.96 (0.60–1.55)	0.88	0.81 (0.50–1.31)	0.39
CHA_2DS_2-VASc score	1.31 (1.12–1.53)	**0.001**	1.21 (1.02–1.44)	**0.03**
Stroke				
OAC use at baseline	0.10 (0.02–0.45)	**0.003**	0.11 (0.02–0.48)	**0.004**
Age	1.02 (0.94–1.12)	0.60	1.00 (0.91–1.10)	0.98
Female sex	0.84 (0.19–3.76)	0.82	0.68 (0.15–3.17)	0.62
CHA_2DS_2-VASc score	1.39 (0.86–2.25)	0.18	1.35 (0.80–2.29)	0.26
Composite outcome (death and stroke)				
OAC use at baseline	0.38 (0.23–0.65)	**<0.001**	0.41 (0.24–0.70)	**0.001**
Age	1.05 (1.02–1.08)	**<0.001**	1.04 (1.01–1.07)	**0.009**
Female sex	0.97 (0.61–1.54)	0.91	0.81 (0.50–1.30)	0.38
CHA_2DS_2-VASc score	1.32 (1.13–1.53)	**<0.001**	1.21 (1.02–1.43)	**0.03**

CHA_2DS_2-VASc, stroke risk score; CIs, confidence intervals; OAC, oral anticoagulation.

that reported by the EORP-AF Pilot study (39.7%).[24] Although 56.6% of patients in the current cohort reported symptoms of AF at baseline, the utilization of cardioversion and/or catheter ablation was only evident in around one-quarter of participants and the use of anti-arrhythmic drugs was very low. This may reflect the finding that most of the symptomatic patients reported that their normal daily activity was not affected by AF symptoms (EHRA score Class II) but may also reflect the sites from which the patients were recruited, as only three were electrophysiology centres.

Strengths and limitations

This registry extended recruitment of AF patients in the UK in the Long-Term Registry on patients with Atrial Fibrillation (AF-GEN) to general practice and other medical specialities, extending knowledge on how AF patients are managed by non-cardiology specialists, also permitting comparison between cardiology and non-cardiology specialists and primary and secondary care. It is a large contemporary cohort but predominantly includes patients managed by cardiologists. Given the relatively small sample size drawn from specialities other

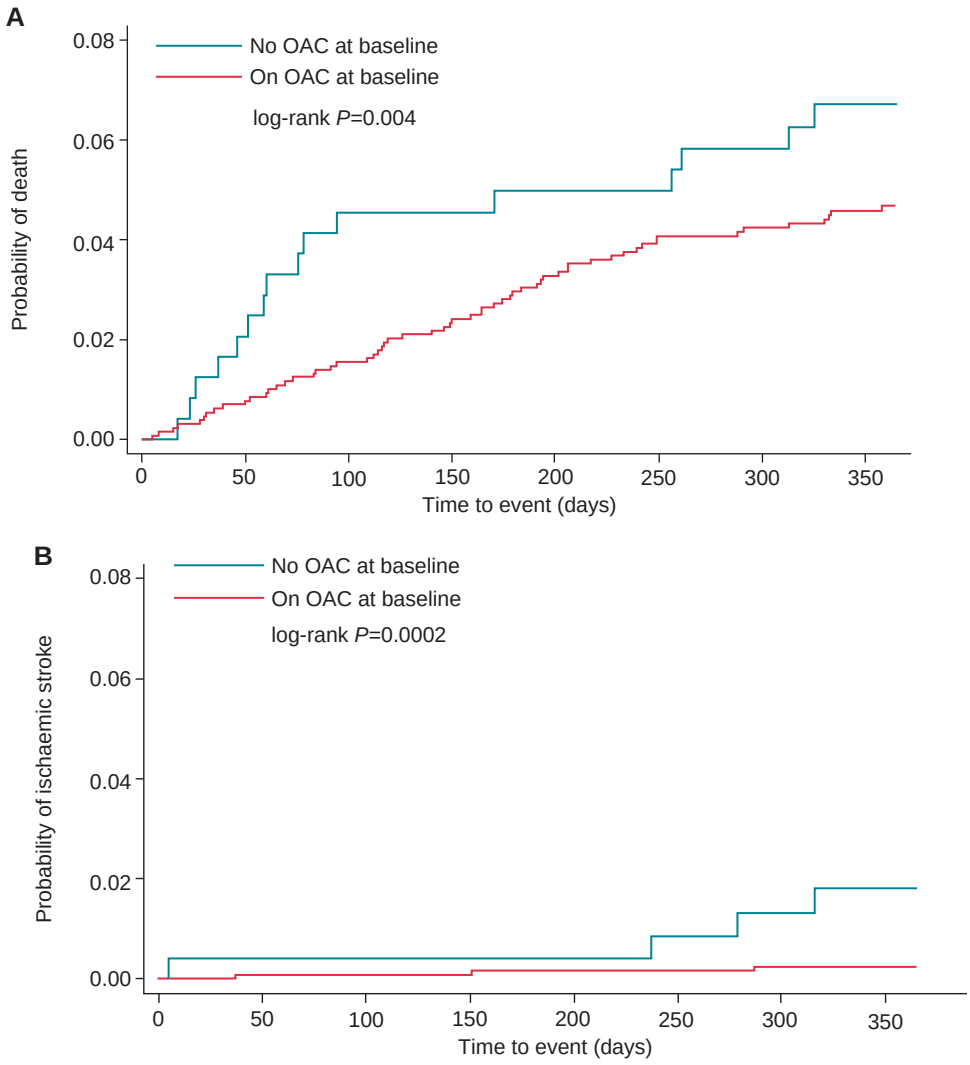

Figure 3 (*A*) Kaplan–Meier curves for all-cause death in those with a CHA_2DS_2-VASc score ≥2 at baseline. (*B*) Kaplan–Meier curves for ischaemic stroke in those with a CHA_2DS_2-VASc score ≥2 at baseline. CHA_2DS_2-VASc, stroke risk score; OAC, oral anticoagulant.

than general practice and cardiology, this may affect the generalizability of the results across these other specialities nationally. This was a pragmatic decision because most AF patients in the UK are managed either by GPs or by cardiologists. To minimize selection bias at the site level, we sought to recruit participating centres to reflect a balance between general practices, specialist centres, community hospitals, and university hospitals. However, only three specialist EP centres were included and this may underestimate the true picture of symptomatic AF and the rhythm-control management in the UK. This registry provides a snapshot of current practice at the time of the data collection and follow-up on June 2017 and June 2019.

Conclusions

Overall OAC use was high (>84%) with NOAC prescription predominating, but rates varied by speciality, with VKA prescription significantly higher in primary care. Guideline-adherent OAC therapy at baseline was associated with significant reduction in death and stroke at 1 year, regardless of speciality. This highlights the need for appropriate OAC prescription and further improvement of OAC adherence. Rhythm-control management was only evident in around one-quarter despite AF symptoms being reported in 56.6%; however, only 17.9% reported severe symptoms. This registry extends the knowledge of contemporary management of AF outside cardiology by including primary care, stroke, acute, and emergency medicine, and demonstrates good implementation of clinical guidelines for the management of AF, particularly in relation to stroke prevention.

Supplementary material

Supplementary material is available at *Europace* online.

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Data availability

Written requests for data availability made by other investigators will be considered by the authors and made available where deemed appropriate.

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