ORIGINAL ARTICLE

Ethnicity and stroke risk in patients with atrial fibrillation

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ABSTRACT

Objective To examine the prevalence of atrial fibrillation (AF) and stroke risk by ethnic group in south and east London; to compare classification with CHA2DS2VASC and CHADS2; to examine the appropriateness of anticoagulant treatment and historic trends in prescribing by gender, age, and ethnicity.

Design Cross-sectional study.

Setting Routine general practice records from south and east London.

Patients Patients aged 18 years or over with AF.

Main outcome measures Risk of stroke by CHA2DS2VASC and CHADS2 score, and prescription of anticoagulant.

Results In 2011, we identified 6292 patients with AF, with an age adjusted prevalence of 0.63% (1.2% white, 0.4% black African/Caribbean and 0.2% South Asian). 93% of the AF population were at high risk of stroke with a CHA2DS2VASC score ≥1, of whom 54% were on warfarin. South Asian patients were at higher stroke risk than white patients (OR 1.67, 95% CI 1.02 to 2.73). Warfarin under-prescribing in people over 80 years of age persisted without improvement throughout 2008–2011. There were no clear differences in warfarin use by ethnic group.

Conclusions Despite a reduced prevalence of AF among South Asian patients, their risk of stroke is higher than for white patients or black African/Caribbean patients in association with diabetes, cardiovascular disease, and hypertension. Under-prescription of anticoagulation persists in all ethnic groups, a deficit most pronounced in the elderly. Use of the CHA2DS2VASC score would enhance optimal management in primary care.

INTRODUCTION

Atrial fibrillation (AF) is the most common cardiac arrhythmia, with a prevalence that rises from 0.7% in people aged 55–59 years to 18% in those over 85 years.1 It is associated with a 3–5-fold increased risk of stroke, influenced particularly by age and risk factors such as hypertension, diabetes, and cardiovascular disease.2 13 “Two recent reviews have summarised the epidemiology and management of AF from a global perspective in high and low-middle income countries.4 4 The prevalence of AF is lower among black African/Caribbean and South Asian ethnic groups than in the white population, despite a greater preponderance of risk factors and stroke in African/Caribbean black groups and cardiovascular disease of all types in South Asians.2 5 6 Social deprivation is also independently associated with AF.7 Black and South Asian patients with AF have a greater risk of stroke in association with hypertension and diabetes than their white counterparts.8 These consistent ethnic differences in prevalence and outcome are unlikely to be due to differential ascertainment.9

Guidelines recommend anticoagulation for patients at moderate to high risk of stroke, defined by the earlier CHADS2 or more recent CHA2DS2VASC score ≥1.10–14 In 2011 new oral anticoagulant agents were licensed in the UK and recommended by the National Institute for Health and Care Excellence (NICE) where warfarin could not be used. In addition the failure of aspirin to reduce stroke in AF and the risk of bleeding at older ages has been emphasised to ensure appropriate use.15 16

Both in the UK and internationally, only half of all patients with AF receive warfarin, with significant under-prescribing in the elderly and others at highest risk.17 18 Unlike treatment for hypertension and lipids, anticoagulation rates in the UK have shown only limited improvement over time.19 A recent national survey from UK general practice showed a slow increase in anticoagulant use in those with a CHADS2 score ≥2 from 49.7% in 2007 to 53.0% in 2010.20 No socioeconomic gradient in the prescribing of antithrombotics has been found in the UK.17 However, in the USA, black and ethnic minority patients with AF are less likely to receive treatment with warfarin.21

This is the first study to report CHA2DS2VASC scores by ethnic group and their relationship to anticoagulant prescribing. We report the prevalence of AF by ethnic group in an entire unselected population in south and east London. We compare classification using CHA2DS2VASC with CHADS2 (as the latter has historically been the score used in UK primary care) to determine the extent of reclassification of low risk individuals and to examine the appropriateness of anticoagulant treatment over time in relation to gender, age and ethnicity.

METHODS

The study conformed to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) study design recommendations.22

Setting The study was located in four inner London boroughs with a socially and ethnically diverse population of 1.3 million: Lambeth in the south, and Tower Hamlets, Newtown and City & Hackney in the east.
Eligibility criteria
Patients aged 18 years or over registered with general practitio-
ners (GPs) were included if they had a diagnostic read code for
AF, including both paroxysmal and persistent forms, recorded in
the electronic patient medical record; 96% were recorded as veri-
fi ed by ECG. Patients who had a code for AF resolved follow-
ing their most recent diagnosis were excluded. Patients with atrial
flutter were not included. All patients with recorded AF were
included in the study; there were no exclusions.

Data collection
Anonymised data were extracted on an annual basis from June
2008 to June 2011 from the electronic health records of 1.3
million people registered with 51 out of 52 general practices in
Lambeth and 136 out of 145 general practices in east London.
These practices include 95% of the population registered with
GPs in these geographic areas. These data were extracted using
EMIS Web in east London and MIQUEST in Lambeth.

Demographic variables extracted included age, gender, ethni-
city, and social deprivation. Ethnicity was self-reported by
patients and, for the purposes of this study, fell into six categories
derived from the 2001 census: white (British, Irish, other white);
South Asian (Bangladeshi, Indian, Pakistani, other Asian); black
(African, Caribbean, black British); mixed; other (Chinese and
any other recorded ethnic group); and not stated. Patients whose
ethnicity could not be classified from the recorded entry due to
non-response or coding error were categorised as not stated.
Townsend score—a measure of social deprivation based on
census derived measures of overcrowding, car ownership, and
education—was available in the east London health records on a
small area basis. In Lambeth this was derived by converting the
similar Index of Multiple Deprivation.

Variables required to calculate the CHADS2 and
CHA2DS2VASc scores included congestive heart failure, hyper-
tension, diabetes mellitus, stroke/transient ischaemic attack and
cardiocascular disease. Prescriptions issued and contraindica-
tions recorded for warfarin, aspirin, clopidogrel, dipyridamole,
dabigatran, and parenteral anticoagulants in the last 12 months
were also extracted. The absence of a clinical code for disease
diagnosis, prescription issued, or contraindication indicated that
these were not present.

Statistical analysis
The crude prevalence of AF in the study practices in June 2011
was calculated using the entire general practice population at all
ages as the denominator and then directly age standardised
using the European Union standard population.

Risk of stroke using both the CHADS2 and CHA2DS2VASc
scores was calculated for each patient and the ethnic differences
in the component risk factors were calculated. Patients were
classified as being at high stroke risk if their CHA2DS2VASc
score was ≥1 or their CHADS2 score was ≥2 and the extent of
reclassi fi cation determined.

Logistic regression analysis using Stata V10 estimated whether
the odds of being at high risk of stroke using both CHADS2 and
CHA2DS2VASc differed by ethnic group. The logistic regression
model for stroke risk using CHADS2 was adjusted for sex,
local authority in which the practice was located, and
Townsend deprivation score. Since sex is a component of the
CHA2DS2VASc score, the logistic regression model for stroke
risk using CHA2DS2VASc did not include further adjustment
for sex. In both analyses, the standard errors were adjusted to
account for the effect of clustering at practice level.

Prescription of warfarin according to stroke risk was evalu-
ated. For each level of the CHA2DS2VASc score, the proportion
of patients with and without a prescription for warfarin in
the previous 12 months was calculated. Patients without a pre-
scription for warfarin were further subdivided into those with
and without recorded contraindications for warfarin on their
GP record.

Logistic regression was used to analyse repeated cross sec-
tional reports of the data for each year between 2008 and 2011
to examine chronological changes in the odds of being on war-
farin therapy for patients at high risk of stroke. This analysis
used CHADS2 as this was used at the time to guide anticoagula-
tion. All models were adjusted for age, gender, ethnic group,
local authority in which the practice was located, and clustering
by practice.

RESULTS
Prevalence
In July 2011, a total population of 1 322 632 patients aged
18 years or over was registered with 187 of the total 197 GPs
providing primary care in the four study London Boroughs.

Figure 1  Prevalence of atrial
fibrillation by ethnic and age group,
2011.
Eight practices did not take part because of technical obstacles to data access, and two practices declined to provide data. The ethnic breakdown of this study population was 72.5% white, 7.2% South Asian, 9.4% black African/Caribbean, 4.8% other ethnic group, and 6.2% not stated.

A total of 6292 patients were recorded as having AF. The age, sex, and ethnic distribution of these patients is set out in the online supplementary appendix table 1. Sixty-seven per cent were aged 70 years or older. The crude prevalence of AF in the study population was 0.48%. After adjusting to the European standard population, this figure increased to 0.63%. The prevalence of AF was highest in the white population (1.2%), followed by the black African/Caribbean (0.40%) and South Asian populations (0.22%). Figure 1 illustrates the ethnic age differences in prevalence.

### Risk of stroke using CHADS2 and CHA2DS2VASc

A CHADS2 score ≥1 identified 5284 individuals at high risk for stroke. The CHA2DS2VASc algorithm reclassified 350 patients from a CHADS2 score of zero to a CHA2DS2VASc score of 1, increasing the proportion of patients at high risk from 84.0% to 92.7% and decreasing the proportion of patients at low risk from 16.0% to 7.3%. No patient was reclassified from high to low risk.

An examination of the ethnic differences in the components of the CHADS2 and CHA2DS2VASc shows that South Asian and black African/Caribbeans with AF tended to be younger than white people. However, South Asians had particularly high rates of diabetes and vascular disease and both South Asians and black African/Caribbeans were more likely to have hypertension (table 1).

Table 2 describes the odds of being at high risk for stroke by ethnic group for both risk scores. Using either score there was a significant increase in the risk of stroke among South Asian but not black people compared to white people (CHADS2 score OR 1.42, 95% CI 1.04 to 1.93; CHA2DS2VASc score OR 1.67, 95% CI 1.02 to 2.73).

### Warfarin prescription by level of stroke risk

Figure 2 describes the proportion of patients receiving anticoagulant treatment according to stroke risk classified using CHA2DS2VASc.

Of those with CHA2DS2VASc ≥1, 53.4% were prescribed warfarin in the preceding 12 months. Of the 46.6% at high risk not prescribed warfarin in the past 12 months, 8.2% had contraindications in their patient record. Warfarin prescription increased only modestly with increasing risk among those without contraindication: from 47.5% for those with a score of 1, to 56.3% for a score of 8.

Of those patients with a CHA2DS2VASc score of zero, 1.27% had heart valvular disorders for which warfarin treatment is indicated. However, we found that 34.3% of those patients with a CHA2DS2VASc score of zero were prescribed warfarin.

For 2011, we examined inequalities in warfarin prescribing in those at high risk CHA2DS2VASc ≥1. The results highlight under-prescribing for women (OR 0.84, 95% CI 0.75 to 0.93) and age over 80 years (OR 0.63, 95% CI 0.53 to 0.74) (p<0.001), but show no clear difference in the odds of prescription by ethnic group (see online supplementary appendix table 2).

The proportion of people with AF treated with warfarin increased from 44.3% to 51.0% over the period 2008–11 (see online supplementary appendix table 3).

**DISCUSSION**

**Main findings**

Using routinely recorded practice data from a multi-ethnic area in inner London, we describe differing prevalence of AF for the three major ethnic groups in this locality. Other studies have
found fewer cases in both black African/Caribbean and South Asian populations compared to white groups.6 9 24 This is the case even though risk factors for cardiovascular disease are more prevalent among these ethnic groups. Access to and utilisation of health care in the UK setting is unlikely to have an impact on differential case definition. Indeed related studies in east London found that South Asian groups, which have the lowest rates of AF, are more likely to attend and take up medications and interventions for the management of hypertension and cardiovascular disease.25 26

Our study is the first to identify stroke risk by ethnic group. Using either stroke risk algorithm, South Asians are more likely to be at higher risk of stroke than white people with an odds ratio of CHA2DS2VASC ≥1 of 1.67 (95% CI 1.02 to 2.73; p=0.041). Analysis of the score components identifies younger age, diabetes, and hypertension as more prevalent in South Asian and black African/Caribbeans and pre-existing vascular disease in South Asians as compared to white people with AF. These comorbidities are well recognised in the general populations of South Asians and black African/Caribbeans. The CHA2DS2VASC score increases discrimination for patients at lower stroke risk27 and identified an additional 350/6292 people (8.7%) with AF who would benefit from anticoagulants. This is a similar extent of reclassification found in a Canadian study of routine health system data.18 Many studies have demonstrated the gap between those with AF who would benefit from anticoagulation and the proportion taking warfarin. The proportion taking warfarin increased from around 20–30% in the 1990s19 to around 35–40% in the period 1999–2008.28 Our study shows a further modest improvement, from 44% to 51% between 2008 and 2011, which supports the findings of another UK based longitudinal series study published in 2012.20 Similarly we found that the prescribing of warfarin is poorly related to stroke risk and is lowest among those over 80 years, a pattern that persisted unchanged throughout the study period.

### Table 3  Odds of being on warfarin therapy for patients with CHADS2 score ≥2 by ethnic group 2008–2011

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% CI</td>
<td>p Value</td>
<td>OR</td>
</tr>
<tr>
<td>White (ref)</td>
<td>1</td>
<td>–</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>South Asian</td>
<td>0.64</td>
<td>(0.46 to 0.89)</td>
<td>0.008</td>
<td>0.90</td>
</tr>
<tr>
<td>Black</td>
<td>0.81</td>
<td>(0.60 to 1.08)</td>
<td>0.143</td>
<td>0.83</td>
</tr>
<tr>
<td>Mixed</td>
<td>1.34</td>
<td>(0.73 to 2.49)</td>
<td>0.346</td>
<td>1.21</td>
</tr>
<tr>
<td>Other</td>
<td>1.05</td>
<td>(0.61 to 1.82)</td>
<td>0.851</td>
<td>0.53</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (ref)</td>
<td>1</td>
<td>–</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>0.92</td>
<td>(0.78 to 1.07)</td>
<td>0.281</td>
<td>0.97</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;60</td>
<td>1.02</td>
<td>(0.70 to 1.47)</td>
<td>0.930</td>
<td>0.89</td>
</tr>
<tr>
<td>60–69 (ref)</td>
<td>1</td>
<td>–</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>70–79</td>
<td>1.01</td>
<td>(0.77 to 1.31)</td>
<td>0.967</td>
<td>1.00</td>
</tr>
<tr>
<td>≥80</td>
<td>0.58</td>
<td>(0.45 to 0.76)</td>
<td>&lt;0.001</td>
<td>0.54</td>
</tr>
</tbody>
</table>

Figures in bold are those which show a significant difference where P <0.05.
in the USA, we found no consistent evidence of inequity in warfarin treatment by ethnicity or social deprivation using either the CHADS$_2$ or CHA$_2$DS$_2$VASC. They also found that for those at older ages in all ethnic groups, prescribing remains poorly related to risk in all ethnic groups, particularly at older ages.

Practices and commissioning organisations should adopt the CHA$_2$DS$_2$VASC score and promote clinical review of anticoagulation and cardiovascular risk factors. Further important improvements in prescribing coverage can be made particularly for those at older ages in all ethnic groups.

Contributors RM and EP contributed equally to the design, data collection and analysis, and to the drafting of the manuscript. JR and SH helped design the study and drafted the discussion. All authors contributed to advising on methods of data analysis and reviewing and revising the manuscript. JR is responsible for the overall content as guarantor.

Competing interests None.

Ethics approval All data was anonymised and managed according to UK NHS information governance requirements. Ethical approval was not required for this observational study. This study forms part of a wider cardiovascular health inequalities study based on Lambeth Dataset and approved by the South East Research Ethics Committee (07/MRE01/26).

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Heart rhythm disorders


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