ORIGINAL ARTICLE

Ethnicity and stroke risk in patients with atrial fibrillation

Rohini Mathur,[1] Elizabeth Pollara,[2] Sally Hull,[1] Peter Schofield,[2] Mark Ashworth,[2] John Robson[1]

▸ Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/heartjnl-2013-303767).

[1]Centre for Primary Care and Public Health, Queen Mary University of London, London, UK
[2]Department of Primary Care & Public Health Sciences, King's College London, London, UK

Correspondence to
John Robson, Centre for Primary Care and Public Health, Queen Mary University of London, London E1 2AB, UK;
j.robson@qmul.ac.uk

Received 6 February 2013
Revised 24 April 2013
Accepted 25 April 2013
Published Online First 29 May 2013

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 CHA_2DS_2VASc and $CHADS_2$; 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 CHA_2DS_2VASc and $CHADS_2$ 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 CHA_2DS_2VASc 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 CHA_2DS_2VASc 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 3] Two recent reviews have summarised the epidemiology and management of AF from a global perspective in high and low-middle income countries.[3 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.[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 $CHADS_2$ or more recent CHA_2DS_2VASc 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 $CHADS_2$ 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 CHA_2DS_2VASc 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 CHA_2DS_2VASc with $CHADS_2$ (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, Newham and City & Hackney in the east.

To cite: Mathur R, Pollara E, Hull S, *et al*. *Heart* 2013;**99**:1087–1092.

Eligibility criteria

Patients aged 18 years or over registered with general practitioners (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 verified by ECG.[23] Patients who had a code for AF resolved following 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, ethnicity, 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 $CHADS_2$ and CHA_2DS_2VASc scores included congestive heart failure, hypertension, diabetes mellitus, stroke/transient ischaemic attack and cardiovascular disease. Prescriptions issued and contraindications 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 $CHADS_2$ and CHA_2DS_2VASc 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 CHA_2DS_2VASc score was ≥ 1 or their $CHADS_2$ score was ≥ 2 and the extent of reclassification determined.

Logistic regression analysis using Stata V.10 estimated whether the odds of being at high risk of stroke using both $CHADS_2$ and CHA_2DS_2VASc differed by ethnic group. The logistic regression model for stroke risk using $CHADS_2$ was adjusted for sex, local authority in which the practice was located, and Townsend deprivation score. Since sex is a component of the CHA_2DS_2VASc score, the logistic regression model for stroke risk using CHA_2DS_2VASc 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 evaluated. For each level of the CHA_2DS_2VASc score, the proportion of patients with and without a prescription for warfarin in the previous 12 months was calculated. Patients without a prescription 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 sectional reports of the data for each year between 2008 and 2011 to examine chronological changes in the odds of being on warfarin therapy for patients at high risk of stroke. This analysis used $CHADS_2$ as this was used at the time to guide anticoagulation. 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.

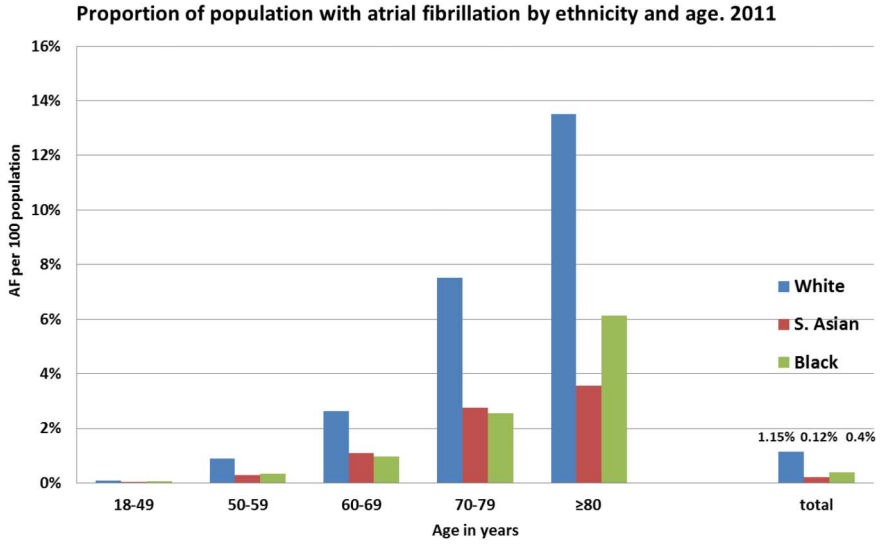


Figure 1 Prevalence of atrial fibrillation by ethnic and age group, 2011.

Table 1 Ethnic breakdown of CHA_2DS_2VASc score components

	White	South Asian	Black African/ Caribbean	Whole AF population
N	4561	450	589	6292
% ≥65 years	79.7	69.1	71.1	76.7
% ≥75 years	57.4	36.9	47.4	53.3
% female	54.4	51.8	48.6	53.9
% with diabetes	21.1	47.3	34.5	24.6
% with heart failure	11.6	14.0	15.3	11.9
% with stroke	19.3	20.9	22.2	19.3
% with vascular disease	30.0	45.3	25.6	30.1
% with hypertension	65.3	70.2	78.4	65.9

AF, atrial fibrillation.

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 $CHADS_2$ and CHA_2DS_2VASc

A $CHADS_2$ score ≥1 identified 5284 individuals at high risk for stroke. The CHA_2DS_2VASc algorithm reclassified 550 patients from a $CHADS_2$ score of zero to a CHA_2DS_2VASc 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 $CHADS_2$ and CHA_2DS_2VASc 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 ($CHADS_2$ score OR 1.42, 95% CI 1.04 to 1.93; CHA_2DS_2VASc 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 CHA_2DS_2VASc.

Of those with $CHA_2DS_2VASc \geq 1$, 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 CHA_2DS_2VASc 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 CHA_2DS_2VASc score of zero were prescribed warfarin.

For 2011, we examined inequalities in warfarin prescribing in those at high risk $CHA_2DS_2VASc \geq 1$. 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).

Considering patients for whom anticoagulant therapy is recommended, we examined the odds of being prescribed warfarin by ethnic group, age, sex and changes over 4 years using data from 2008 to 2011 (table 3). We used $CHADS_2 \geq 2$ to define high risk as this was recommended clinical practice during this period. We found consistent under prescribing for the oldest patients over the age of 80 years (2008 OR 0.58, 95% CI 0.45 to 0.76; 2011 OR 0.48, 95% CI 0.38 to 0.60). Although gender and ethnic differences were present in some years there was no consistent trend over time.

DISCUSSION

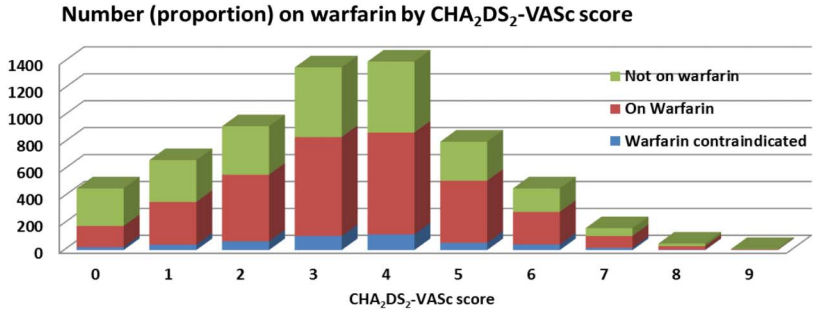
Main findings

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

Table 2 Odds of being at high risk for stroke as defined by $CHADS_2$ and CHA_2DS_2VASc by ethnic group, 2011

		$CHADS_2$				CHA_2DS_2VASc			
Ethnic group	N	% at high risk of stroke	Adjusted OR*	95% CI	p Value	% at high risk of stroke	Adjusted OR†	95% CI	P value
Total AF population	6292	84.0				92.7			
White (ref)	4561	84.3	1	–		92.8	1	–	
South Asian	450	89.8	**1.42**	**1.04 to 1.93**	**0.025**	96.0	**1.67**	**1.02 to 2.73**	**0.041**
Black	589	86.1	1.06	0.82 to 1.37	0.648	93.9	1.13	0.76 to 1.69	0.538

*Adjusted ORs for $CHADS_2$ account for sex, local authority area in which practice is located, Townsend deprivation score, and clustering by practice.
†Adjusted ORs for CHA_2DS_2VASc account for local authority area in which practice is located, Townsend deprivation score, and clustering by practice.
AF, atrial fibrillation.
Figures in bold are those which show a significant difference where P <0.05.



N	458	668	920	1357	1407	805	458	163	48	8
% not on warfarin no contraindications	60.9%	46.6%	39.1%	38.1%	37.9%	36.0%	38.0%	35.6%	37.5%	37.5%
% on warfarin	34.3%	47.5%	53.8%	54.2%	53.8%	57.3%	52.8%	54.6%	56.3%	50.0%
% warfarin contraindicated	4.8%	6.0%	7.1%	7.7%	8.3%	6.7%	9.2%	9.8%	6.3%	12.5%

Figure 2 Warfarin prescription by CHA_2DS_2VASc score, 2011.

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 $CHA_2DS_2VASc \geq 1$ 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 CHA_2DS_2VASc score increases discrimination for patients at lower stroke risk[27] and identified an additional 550/6292 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 1990s[19] 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. In contrast to reports

Table 3 Odds of being on warfarin therapy for patients with $CHADS_2$ score ≥2 by ethnic group 2008–2011

	2008			2009			2010			2011		
	N=2790			N=3400			N=3237			N=3830		
	OR	95% CI	p Value	OR	95% CI	p Value	OR	95% CI	p Value	OR	95% CI	p Value
Ethnicity												
White (ref)	1	–		1	–		1	–		1	–	
South Asian	**0.64**	**(0.46 to 0.89)**	**0.008**	0.90	(0.69 to 1.16)	0.394	0.74	(0.48 to 1.15)	0.177	0.82	(0.61 to 1.10)	0.179
Black	0.81	(0.60 to 1.08)	0.143	0.83	(0.63 to 1.09)	0.173	0.79	**(0.63 to 0.99)**	**0.038**	**0.80**	**(0.65 to 0.99)**	**0.036**
Mixed	1.34	(0.73 to 2.49)	0.346	1.21	(0.56 to 2.60)	0.631	1.02	(0.46 to 2.24)	0.969	1.28	(0.75 to 2.18)	0.364
Other	1.05	(0.61 to 1.82)	0.851	**0.53**	**(0.34 to 0.82)**	**0.004**	0.81	(0.51 to 1.29)	0.380	1.01	(0.70 to 1.46)	0.966
Sex												
Male (ref)	1	–		1	–		1	–		1	–	
Female	0.92	(0.78 to 1.07)	0.281	0.97	(0.84 to 1.13)	0.731	0.94	(0.82 to 1.08)	0.362	**0.85**	**(0.75 to 0.96)**	**0.010**
Age (years)												
<60	1.02	(0.70 to 1.47)	0.930	0.89	(0.64 to 1.24)	0.496	0.72	(0.49 to 1.03)	0.074	0.81	(0.57 to 1.15)	0.241
60–69 (ref)	1	–		1	–		1	–		1	–	
70–79	1.01	(0.77 to 1.31)	0.967	1.00	(0.79 to 1.26)	0.973	0.85	(0.67 to 1.08)	0.192	0.84	(0.67 to 1.05)	0.127
≥80	**0.58**	**(0.45 to 0.76)**	**<0.001**	**0.54**	**(0.43 to 0.67)**	**<0.001**	**0.49**	**(0.38 to 0.62)**	**<0.001**	**0.48**	**(0.38 to 0.60)**	**<0.001**

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_2DS_2VASc.[29] There may also be an appreciable amount of overtreatment among cases at low risk, of which venous thromboembolism is likely to account for only a small proportion.

The slow increase in anticoagulation treatment represents both professional uncertainty and the difficulty of initiation in older people, many of whom have multiple comorbidities, social complexity, and polypharmacy. In clinical trials 20% typically discontinue treatment and this figure may be higher in routine practice.[30] However, even in more complex cases, high rates of anticoagulation can be achieved and greater benefits accrue to routine warfarin users than non-users.[31] Professional doubt and uncertainty have compounded the issue, with well designed trials completed as recently as 2007[32] and restatement and refinement of the role of anticoagulants and antiplatelet agents in 2012.[15] Robust evidence for the effectiveness of anticoagulants in real world settings and authoritative guidance on the use of new oral anticoagulant agents are now available and supported by national initiatives. The UK Quality and Outcomes Framework introduced AF risk scoring in 2012. Risk stratification tools for AF and information are available online.[33 34] Complexity is a major issue for many older people, but improved clinical skills and organisational support for care processes and patients demonstrate improvements even in the most complex of situations.[35]

Those at highest risk include the elderly in all ethnic groups, and improvement in prescribing according to risk is a feasible goal. This study highlights that the particularly high risk of stroke in South Asians relates to diabetes, hypertension, and cardiovascular multi-morbidity, emphasising the relevance of other cardiovascular risk factors to the management of AF.

Strengths and weaknesses of the study

The size of the dataset, the use of entire populations to provide geographically contiguous data, and the ethnic diversity with high levels of self-reported ethnicity recording (94% across the whole study population) provide good evidence for ethnic and social differences in prevalence and the process of care that are described. The use of structured data entry templates, along with clinical facilitation in the east London practices, enables routine entry of high quality data by a range of clinicians using agreed code sets and validated AF diagnoses.[34]

Weaknesses include a locally but not nationally representative sample, though prescribing is likely to broadly represent current professional practice. Our South Asian population is heterogeneous, being largely of Bangladeshi and Indian origin with fewer from Pakistan; similarly the black population comprises a longstanding Caribbean population and a more recent sub-Saharan African population. It is possible that grouping these populations conceals between group differences. The age distribution of the reference population, in this case 18 years and older, has a profound impact on prevalence rates. The study area has an exceptionally young and ethnically diverse population and this is likely to account for the lower than average prevalence of AF.

CONCLUSION

This study suggests that for people with AF only modest progress has been made in the last 4 years to improve warfarin prescribing from 44% to 51%. Although prevalence is lower in the black African/Caribbean and South Asian populations, those South Asians who have AF are likely to be at higher risk than their white counterparts. Prescribing remains poorly related to risk in all ethnic groups, particularly at older ages.

Practices and commissioning organisations should adopt the CHA_2DS_2VASc 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 DataNet and approved by the South East Research Ethics Committee (07/MREOI/26).

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1 Heeringa J, Van der Kuip DAM, Hofman A, *et al*. Prevalence, incidence and lifetime risk of atrial fibrillation: the Rotterdam study. *Eur Heart J* 2006;27:949–53.
2 Wolf PA, Abbott RD, Kannel WB. Atrial fibrillation as an independent risk factor for stroke: the Framingham Study. *Stroke* 1991;22:983–8.
3 Lip GYH, Brechin CM, *et al*. The global burden of atrial fibrillation and stroke: a systematic review of the epidemiology of atrial fibrillation in regions outside North America and Europe. *Chest* 2012;142:1489–98.
4 Ball J, Carrington MJ, McMurray JJV, *et al*. Atrial fibrillation: profile and burden of an evolving epidemic in the 21st century. *Int J Cardiol* 2003;142: Published Online First: 1 February 2013. doi:10.1016/j.ijcard.2012.12.093
5 Gill PS, Calvert M, Davis R, *et al*. Prevalence of heart failure and atrial fibrillation in minority ethnic subjects: the Ethnic-Echocardiographic Heart of England Screening Study (E-ECHOES). *PLoS ONE* 2011;6:e26710.
6 Lambert A, Burden F, Rouse A. prevalence of vascular disease related conditions amongst various cultural (ethnic) groups in Birmingham, UK. http://medweb4.bham.ac.uk/websites/key_health_data/2009/ch_11.htm (accessed 14 Mar 2013).
7 Stewart JA, Dundas R, Howard RS, *et al*. Ethnic differences in incidence of stroke: prospective study with stroke register. *BMJ* 1999;318:967–71.
8 Soliman EZ, Alonso A, Goff DC. Atrial fibrillation and ethnicity: the known, the unknown and the paradox. *Fut Cardiol* 2009;5:547–56.
9 Gunarathne A, Patel JV, Gammon B, *et al*. Ischemic stroke in South Asians: a review of the epidemiology, pathophysiology, and ethnicity-related clinical features. *Stroke* 2009;40:e415–423.
10 NICE. Atrial fibrillation—dabigatran etexilate: guidance. http://publications.nice.org.uk/dabigatran-etexilate-for-the-prevention-of-stroke-and-systemic-embolism-in-atrial-fibrillation-ta249 (accessed 31 Jan 2013).
11 NICE. CG36 Atrial fibrillation: full guideline. http://guidance.nice.org.uk/CG36/Guidance/pdf/English (accessed 6 Dec 2010).
12 Camm AJ, Lip GYH, De Caterina R, *et al*. 2012 focused update of the ESC Guidelines for the management of atrial fibrillation: an update of the 2010 ESC Guidelines for the management of atrial fibrillation—developed with the special contribution of the European Heart Rhythm Association. *Europace* 2012;14:1385–413.
13 Lip GYH, Nieuwlaat R, Pisters R, *et al*. Refining clinical risk stratification for predicting stroke and thromboembolism in atrial fibrillation using a novel risk factor-based approach: the Euro Heart Survey on atrial fibrillation. *Chest* 2010;137:263–72.
14 Olesen JB, Lip GYH, Hansen ML, *et al*. Validation of risk stratification schemes for predicting stroke and thromboembolism in patients with atrial fibrillation: nationwide cohort study. *BMJ* 2011;342:d124.
15 Stott D, Dewar R, Garratt C, *et al*. UK Consensus Conference on 'Approaching the comprehensive management of Atrial Fibrillation: Evolution or revolution?' 2012. http://www.rcpe.ac.uk/clinical-standards/standards/rcpe-af-consensus-statement-2012.pdf (accessed 7 Jul 2012).
16 Aguilar MI, Hart R, Pearce LA. Oral anticoagulants versus antiplatelet therapy for preventing stroke in patients with non-valvular atrial fibrillation and no history of stroke or transient ischemic attacks. *Cochrane Database Syst Rev* 2007;3:CD006186.
17 Murphy NF, Simpson CR, Jhund PS, *et al*. A national survey of the prevalence, incidence, primary care burden and treatment of atrial fibrillation in Scotland. *Heart* 2007;93:606–12.

18 Sandhu RK, Bakal JA, Ezekowitz JA, *et al*. Risk stratification schemes, anticoagulation use and outcomes: the risk–treatment paradox in patients with newly diagnosed non-valvular atrial fibrillation. *Heart* 2011;97:2046–50.
19 Majeed A, Moser K, Carroll K. Trends in the prevalence and management of atrial fibrillation in general practice in England and Wales, 1994–1998: analysis of data from the general practice research database. *Heart* 2001;86:284–8.
20 Holt TA, Hunter TD, Gunnarsson C, *et al*. Risk of stroke and oral anticoagulant use in atrial fibrillation: a cross-sectional survey. *Br J Gen Pract* 2012;62:710–17.
21 Meschia JF, Merrill P, Soliman EZ, *et al*. Racial disparities in awareness and treatment of atrial fibrillation: the reasons for geographic and racial differences in Stroke (REGARDS) study. *Stroke* 2010;41:581–7.
22 STROBE. STROBE Statement: checklist of items that should be included in reports of observational studies. http://www.strobe-statement.org/ (accessed 14 Mar 2013).
23 QOF. GP Quality and Outcomes Framework 2011/12 On-line GP practice database NHS Information Centre. http://www.qof.ic.nhs.uk/ (accessed 14 Mar 2013).
24 Conway DSG, Lip GYH. Ethnicity in relation to atrial fibrillation and stroke (the West Birmingham Stroke Project). *Am J Cardiol* 2003;92:1476–9.
25 Schofield P, Saka O, Ashworth M. Ethnic differences in blood pressure monitoring and control in south east London. *Br J Gen Pract* 2011;61:190–6.
26 Mathur R, Badrick E, Boomla K, *et al*. Prescribing in general practice for people with coronary heart disease; equity by age, sex, ethnic group and deprivation. *Ethn Health* 2011;16:107–23.
27 Olesen JB, Torp-Pedersen C, Hansen ML, *et al*. The value of the CHA2DS2-VASc score for refining stroke risk stratification in patients with atrial fibrillation with a CHADS2 score 0–1: a nationwide cohort study. *Thromb Haemost* 2012;107:1172–9.
28 Lee S, Shafe ACE, Cowie MR. UK stroke incidence, mortality and cardiovascular risk management 1999–2008: time-trend analysis from the General Practice Research Database. *BMJ Open* 2011;1:e000269.
29 Niska R, Han B. Anticoagulation for patients with atrial fibrillation in ambulatory care settings. *J Am Board Fam Med* 2009;22:299–306.
30 Hylek EM, Evans-Molina C, Shea C, *et al*. Major hemorrhage and tolerability of warfarin in the first year of therapy among elderly patients with atrial fibrillation. *Circulation* 2007;115:2689–96.
31 Darkow T, Vanderplas AM, Lew KH, *et al*. Treatment patterns and real-world effectiveness of warfarin in nonvalvular atrial fibrillation within a managed care system. *Curr Med Res Opin* 2005;21:1583–94.
32 Mant J, Hobbs FDR, Fletcher K, *et al*. Warfarin versus aspirin for stroke prevention in an elderly community population with atrial fibrillation (the Birmingham Atrial Fibrillation Treatment of the Aged Study, BAFTA): a randomised controlled trial. *Lancet* 2007;370:493–503.
33 NHS Improvement. Atrial Fibrillation GRASP-AF audit tool—NHS Improvement website. http://www.improvement.nhs.uk/heart/HeartImprovementHome/AtrialFibrillation/tabid/128/Default.aspx (accessed 31 Jan 2013).
34 CEG. Clinical Effectiveness Group—Blizard Institute, Queen Mary University of London. http://blizard.qmul.ac.uk/research-groups/253-clinical-effectiveness-group.html (accessed 31 Jan 2013).
35 Jacobs LG, Billett HH, Freeman K, *et al*. Anticoagulation for stroke prevention in elderly patients with atrial fibrillation, including those with falls and/or early-stage dementia: a single-center, retrospective, observational study. *Am J Geriatr Pharmacother* 2009;7:159–66.

Heart

Ethnicity and stroke risk in patients with atrial fibrillation

Rohini Mathur, Elizabeth Pollara, Sally Hull, Peter Schofield, Mark Ashworth and John Robson

*Heart*2013 99: 1087-1092 originally published online May 29, 2013
doi: 10.1136/heartjnl-2013-303767