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Prevalence of atrial fibrillation in the general population and in high-risk groups: the ECHOES study

Russell C. Davis[1]*, F.D. Richard Hobbs[2], Joyce E. Kenkre[3], Andrea K. Roalfe[2], Rachel Iles[2], Gregory Y.H. Lip[1], and Michael K. Davies[4]

[1]University Department of Medicine, Sandwell & West Birmingham Hospitals NHS Trust, West Bromwich, West Midlands, UK; [2]Department of Primary Care and General Practice, University of Birmingham, Birmingham, West Midlands, UK; [3]Health, Sport and Science, University of Glamorgan, Mid Glamorgan, Wales, UK; and [4]Department of Cardiology, University Hospital Birmingham NHS Trust, Birmingham, West Midlands, UK

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Aims To establish the prevalence of atrial fibrillation (AF) in the general population in the UK, and in those with risk factors.

Methods and results The prevalence of AF on electrocardiography was established in prospectively selected groups: 3960 randomly selected from the population, aged 45+; 782 with a previous diagnosis of heart failure; and 1062 with a record of myocardial infarction, hypertension, angina, or diabetes. Patients were also assessed clinically and with echocardiography. Mortality was tracked for 8 years. Atrial fibrillation was found in 78 of the random population sample (2.0%). Prevalence was 1.6% in women and 2.4% in men, rising with age from 0.2% in those aged 45–54 to 8.0% in those aged 75 and older. Half of all cases were in patients aged 75 and older. Only 23 of the 78 (29.5%) of those in AF took warfarin. Of the 782 patients, 175 (22.4%) with a diagnosis of heart failure were in AF, with normal left ventricular function in 95 (54.3%) of these. Atrial fibrillation was found in 14 of the 244 (5.7%) of those with a history of myocardial infarction, 15 of the 388 (3.9%) of those with hypertension, 15 of the 321 (4.7%) of those with angina, and 11 of the 208 (5.3%) of diabetics. Adjusting for age and sex, mortality was 1.57 times higher for those in AF.

Conclusion Atrial fibrillation is common in the elderly and those with clinical risk factors. Screening these groups would identify many with AF. Use of anticoagulation was low at the time of the initial assessments in the late 1990s; practice may have changed recently.

Keywords Atrial fibrillation • Prevalence • Mortality • Risk factors

Introduction

Atrial fibrillation (AF) is the commonest sustained cardiac arrhythmia, and is associated with a greatly increased risk of embolic stroke. Treatment by anticoagulation with warfarin reduces the risk of stroke in patients with AF by at least two-thirds[1] can be used even in the elderly, and is more effective than aspirin.[2] The new oral direct thrombin inhibitor anticoagulant, dabigatran, has been shown to be superior even to warfarin in stroke reduction, when used at a higher fixed dose.[3] Anticoagulation in AF is therefore one of the most effective prevention measures available in modern medicine, so there is a rationale for screening for AF in the community, with a view to instituting appropriate management in those identified. Indeed, AF can be easily identified with electrocardiography (ECG), making screening potentially feasible in a primary-care setting. In the Screening for Atrial Fibrillation in the agEd (SAFE) study,[4] we recently determined the most cost-effective method of screening for AF in the population aged 65 years and over, as well as its prevalence and incidence in this age group. This contemporary UK study reported that the baseline prevalence of AF was 7.2%, with a higher prevalence in males (7.8%) and patients aged ≥75 years, with an incidence of 0.69–1.64% per year, depending on the screening method. In terms of a screening programme for AF, the SAFE

* Corresponding author. Russell Davis, Sandwell & West Birmingham Hospitals NHS Trust, Sandwell General Hospital, Lyndon, West Bromwich B71 4HJ, UK. Tel: +44 1215 07 2499; fax: +44 1215 07 3865. Email: russell.davis@swbh.nhs.uk

study suggested that only strategy that improved on routine practice was opportunistic screening of subjects attending healthcare professionals for other reasons, rather than targeted screening.

Other epidemiological studies have also established the prevalence of AF in the USA,[5,6] the Netherlands,[7] and England.[8] None of these studies have examined the prevalence of AF in groups prospectively selected because they have risk factors for AF, for example, a clinical diagnosis of heart failure; previous myocardial infarction (MI); angina; and hypertension or diabetes mellitus.

The main aim of our study was to establish the prevalence of AF in the general population, and we also hypothesized that the prevalence would be significantly higher in those with risk factors for the condition. If over half of those in AF can be identified using a search of medical notes or prescription data,[8] and the majority of patients in AF are in the high-risk groups, confining ECG screening to those in these groups would still enable many of the patients in AF to be identified.

Methods

This study was a pre-specified analysis of the ECHOES (Echocardiographic Heart of England Screening) study, a large study primarily designed to establish the prevalence of left ventricular (LV) dysfunction and heart failure. Full details of the methodology have been described previously.[9] This was conducted in 16 primary-care practices in central England from March 1995 to February 1999, representative of the socio-economic and geographic diversity of the UK.

As previously described, 6286 subjects aged 45 and older were chosen at random from the computerized practice registers and invited to attend by letter, with one reminder sent to non-responders. Similarly, 1324 patients with a label of heart failure were identified and invited to participate, as were 1617 patients with one or more clinical risk factors. These were (i) previous MI, (ii) angina, (iii) hypertension, and (iv) diabetes. A random selection of subjects from lists of those in the aforementioned categories was made. In a small number of cases, the same subject may have been selected, for example, as having a diagnosis of heart failure and a history of hypertension. Such subjects were only assessed once, but have been included in the analysis for both groups. The diagnoses of heart failure and the risk factors were obtained by a computerized search of patients' electronic records; diagnoses may have been made on clinical grounds only, and in primary or secondary care.

All patients agreeing to take part in the study were assessed in their own practices by a Clinical Research Fellow in cardiology and a cardiac physiologist. Assessment consisted of: full clinical history (including detailed dyspnoea scoring, past medical history, and medication taken); clinical examination, including blood pressure after 5 min supine rest; 12-lead ECG; and echocardiography including assessment of LV ejection fraction (EF) by area-length method and colour flow and spectral Doppler studies. Details of echocardiographic assessment were as previously described.

Although the patients' pulses were examined clinically, AF was definitively diagnosed using a 12-lead ECG recorded in each case. In cases where the patient had a permanent cardiac pacemaker, AF could be diagnosed if no P-waves or atrial pacing were detected, and there was evidence of fibrillation activity. Left atrial enlargement was diagnosed if the transverse diameter was over 4 cm. Mitral stenosis was diagnosed if the calculated valve area was less than 1.5 cm^2. Valvular regurgitation was graded semi-quantitatively, taking into account chamber size, area and penetration of the regurgitant jet, and continuous wave Doppler signal intensity.

All subjects included in the ECHOES study were flagged by the Office for National Statistics Central Register Office and notifications of deaths were received on a quarterly basis. The analysis here includes notifications of deaths up to 9.5 years from the initial study visit (mean 8 years).

Statistical methods

Patients were stratified by age and sex, and rates for all observations calculated. Prevalence data with 95% confidence intervals were calculated using the exact binomial method. Variables predicting AF were identified by logistic regression analysis, in the general population sample, using a backward elimination process. The final model was confirmed by cross-validation. This involved repeating the logistic regression analysis on two randomly generated subsets of the general population sample. Data were analysed using SPSS 9.0 for Windows and Minitab.

Results

Atrial fibrillation prevalence in the general population

Of the invited general population cohort of 6286 aged 45 and older and chosen at random, 3960 (63%) participated. Atrial fibrillation was present in 78 of these subjects (2.0%, 95% CI 1.6–2.4%). Atrial fibrillation was more slightly common in men (2.4%) than women (1.6%), although this trend was not statistically significant. In both sexes, the prevalence rose steeply with advancing age. The prevalence in men and women, subdivided by age, are summarized in *Table 1* and *Figure 1*.

Symptoms of dyspnoea in the 78 patients from population sample found to be in AF, based on the New York Heart Association (NYHA) functional class are summarized in *Table 1B*. Forty-nine per cent of those in AF gave symptoms of dyspnoea. Of the 78 AF patients, 29 (37%) gave a history of AF or an irregular pulse for which they had sought medical attention.

Patients with a prior clinical diagnosis of heart failure

Of the 782 patients with a previous clinical diagnosis of heart failure, 175 (22.4%, 95% CI 19.5–25.3%) were in AF when seen—significantly more than the general population sample ($P \leq 0.001$) (*Table 2A*). The prevalence in males was not significantly different from that in females ($P > 0.05$). Of those with a label of heart failure who were in AF, 40 (22.9%) had definite LV systolic impairment (EF <40%), a further 40 (22.9%) had borderline systolic function (EF 40–50%), and the remaining 95 (54.3%) had normal systolic function (EF >50%). Significant heart valve disease was found in 46 (26.3%). Of the 175 patients with a previous diagnosis of heart failure who were in AF when seen, 74 (42.3%) were taking warfarin at the time of assessment. Of the 69 patients aged <75, 46 (66.7%) were on warfarin, including 10 of the 11 aged under 65, whereas only 28 of the 106 patients aged 75 and older (26.4%) were anticoagulated.

Table 1 Prevalence of atrial fibrillation and symptoms of dyspnoea—Population sample

	Male	Female
(*A*) Prevalence of AF by age and sex—population sample		
Aged 45–54	1/633 (0.2%)	1/681 (0.1%)
Aged 55–64	15/623 (2.4%)	3/571 (0.5%)
Aged 65–74	11/480 (2.3%)	8/472 (1.7%)
Aged 75–84	17/205 (8.3%)	13/229 (5.7%)
Aged 85+	3/23 (13.0%)	6/43 (14.0%)
Total	47/1964 (2.4%)	31/1996 (1.6%)

(*B*) Symptoms of dyspnoea of patients from population sample found to be in AF

NYHA class	**Number of patients**
No symptoms of dyspnoea under normal circumstances	40 (51%)
Class II(s): slight limitation of physical activity; dyspnoea on walking more than 200 yards or on stairs	20 (26%)
Class II(m): moderate limitation; dyspnoea walking less than 200 yards	6 (8%)
Class III: marked limitation of physical activity: comfortable at rest but dyspnoea washing and dressing or walking from room to room	7 (9%)
Class IV: dyspnoea at rest, with increased symptoms with any level of physical activity	5 (6%)

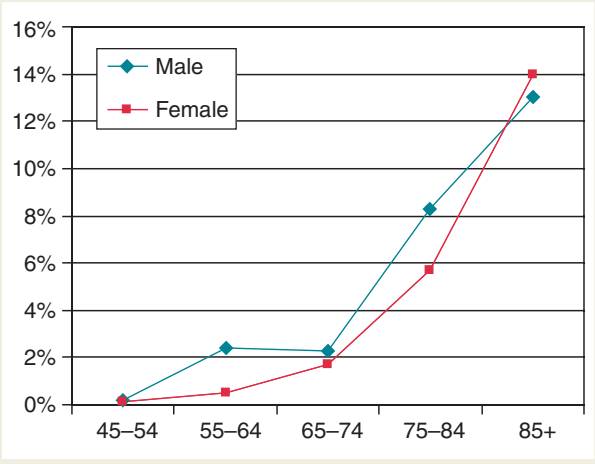

Figure 1 Prevalence of atrial fibrillation by age and sex.

Previous myocardial infarction, hypertension, angina, or diabetes

Of the 244 patients with a previous MI, 14 (5.8%, 95% CI 2.9–8.7%) were in AF when assessed (*Table 2B*): 5 of these were taking warfarin (35.7%), with a further one having stopped it. This prevalence was significantly higher than in the general population sample aged 45+ ($P \leq 0.001$). Of the 388 patients with hypertension, 15 (3.9%, 95% CI 2.0–5.8%) were in AF when seen (*Table 2C*), of whom 4 (26.7%) were anticoagulated with warfarin. This prevalence was again significantly higher than that in the general population aged 45+ ($P \leq 0.025$). Of the 321 patients with angina, 15 (4.7%, 95% CI 2.4–7.0%) with this risk factor were in AF (*Table 2D*). Five (33.3%) were taking warfarin. The proportion of those with angina who were in AF was significantly higher than that of those from the general population sample ($P \leq 0.01$). Of the 208 diabetic patients, 11 (5.3%, 95% CI 2.3–8.3%) were in AF of whom 6 (54.5%) were anticoagulated (*Table 2E*). Unlike any of the other diagnostic categories, AF was found more frequently in the females (6.2%) than the males (4.5%). Atrial fibrillation was significantly more prevalent in the diabetic group than the general population sample ($P \leq 0.01$) (*Figure 2*).

Echocardiographic findings

Associated echocardiographic findings in the 78 patients in AF are shown in *Table 2F*. In total, 66 of the 78 with AF had some echocardiographic abnormality; left atrial enlargement in 76% of cases where measurement was possible, and some degree of mitral regurgitation in 47%.

Treatment of patients in atrial fibrillation at the time of assessment

Of those in AF, 23 (29.5%) were taking warfarin at the time of assessment, of which 2 of whom were also taking aspirin. A further 19 were taking aspirin alone, making a total of 42 (53.8%) of those in AF on anticoagulant or antiplatelet therapy. Of note, 41% (16 of the 39) under the age of 75 were anticoagulated with warfarin whereas only 17.9% ($n = 7$) of those aged 75 and older were anticoagulated. There were no significant gender differences in warfarin use (27.7% of males, 32.3% of females).

Thirty-eight were taking digoxin, 1 sotalol, 7 other beta-blockers, 2 diltiazem, and 4 verapamil; none were taking other anti-arrhythmic drugs. A further five were on medication which may have been for AF (beta-blockers, rate-limiting calcium antagonists or aspirin) but which may have been for other indications. Of note, 28 of the 29 giving a history of AF were on medication.

Table 2 Prevalence of AF by age and sex in groups at risk

	Male	Female
(*A*) Patients with diagnosis of heart failure		
Aged 45–54	0/17	0/6
Aged 55–64	4/56 (7.1%)	7/44 (15.9%)
Aged 65–74	37/139 (26.6%)	21/122 (17.2%)
Aged 75–84	44/152 (28.9%)	38/157 (24.2%)
Aged 85+	10/32 (31.3%)	14/57 (24.6%)
Total	95/396 (24.0%)	80/386 (20.7%)
(*B*) Patients with a medical record of myocardial infarction		
Aged 45–54	0/22	0/9
Aged 55–64	2/37 (5.4%)	0/13
Aged 65–74	3/68 (4.4%)	2/40 (5.0%)
Aged 75–84	5/24 (20.8%)	0/21
Aged 85+	1/2 (50%)	1/8 (12.5%)
Total	11/153 (7.2%)	3/91 (3.3%)
(*C*) Patients with a medical record of hypertension		
Aged 45–54	0/33	0/20
Aged 55–64	2/55 (3.6%)	0/58
Aged 65–74	5/72 (6.9%)	3/80 (3.8%)
Aged 75–84	2/72 (5.9%)	2/30 (6.7%)
Aged 85+	1/3 (33%)	0/3
Total	10/197 (5.1%)	5/191 (2.6%)
(*D*) Patients with a medical record of angina		
Aged 45–54	0/23	0/12
Aged 55–64	2/43 (4.7%)	0/36
Aged 65–74	2/66 (3.0%)	0/54
Aged 75–84	7/37 (18.9%)	3/37 (8.1%)
Aged 85+	0/4	1/9 (11.1%)
Total	11/173 (6.4%)	4/148 (2.7%)
(*E*) Patients with a medical record of diabetes		
Aged 45–54	0/19	0/10
Aged 55–64	1/39 (2.6%)	0/20
Aged 65–74	3/34 (8.8%)	2/40 (5.0%)
Aged 75–84	1/15 (6.7%)	4/25 (16.0%)
Aged 85+	0/4	0/2
Total	5/111 (4.5%)	6/97 (6.2%)
(*F*) Prevalence of echocardiographic risk factors for thromboembolism in patients from population sample		
Risk factor	Frequency	
Mitral stenosis	1/78 (1.3%)[a]	
Mitral regurgitation	37/78 (47%)[b]	
LV ejection fraction <40%	6/78 (8%)	
LV ejection fraction 40–50%	13/78 (17%)	

[a]A further two cases had mitral valve area between 1.5 and 2.0 cm^2, and two had prosthetic mitral valves.
[b]Mitral regurgitation was severe in 1 case, moderate in 3, and mild in 33. Trivial degrees were also seen in a further seven subjects.

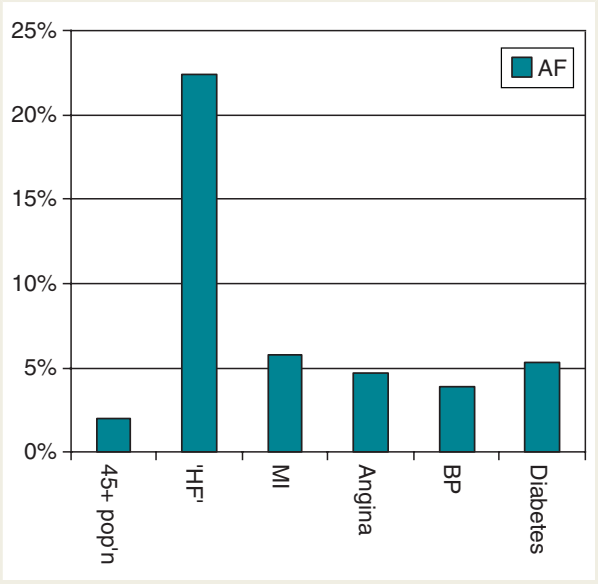

Figure 2 Prevalence of atrial fibrillation in different diagnostic categories.

Therefore, in total, at least 50 (64.1%), and possibly 55 (70.5%) of the 78 subjects in AF were previously known to the primary care physicians to have AF.

Univariate and multivariate predictors of atrial fibrillation

Table 3A shows the univariate analysis of the clinical features found in those patients found to be in AF from the population sample. Patients with AF were more likely to be older and male, and had a higher prevalence of ischaemic heart disease (angina or prior MI), diabetes and high (>90 mmHg) diastolic blood pressure.

When a probability threshold of $P = 0.02$ was chosen, a logistic regression analysis model of predictors of AF correctly identified 73.9%, sensitivity = 65.4%, specificity = 74%, positive predictive value = 5%, and negative predictive value = 99.1% (*Table 3B*). The model suggests that the odds of AF are increased by a factor of 1.7 for males, 1.12 for each year increase in age and 2.55 for persons with diastolic blood pressure at the time of assessment greater than 90 mmHg. High systolic pressure at the time of clinical assessment (>150 mmHg) had a *negative* effect on AF where the odds are decreased by 0.38. The cross-validation analysis confirmed the associations of AF with these variables. A history of hypertension showed only a trend in prediction of AF in the univariate analysis ($P = 0.051$). Distribution of alcohol consumption was heavily skewed, with many non-drinkers participating; however, declared consumption of more than 40 units of alcohol per week was present in 3.8% of those in sinus rhythm and 1.3% of those in AF, and alcohol consumption was not found to be a significant predictor of AF in the analysis.

Survival of subjects in atrial fibrillation

5 year survival of subjects in sinus rhythm from the population cohort of 3960 was 93%. Survival for those in AF was 78%.

Table 3 Statistical analysis of clinical features and prediction model

Variable	AF	Not AF	Test statistic	*P* value
(*A*) Univariate analyses of clinical features in those in AF				
Age mean (s.d.)	73.2 (9.8)	60.9 (10.5)	10.2[a]	<0.0001
Height mean (s.d.)	1.7 (0.1)	1.7 (0.1)	0.9[a]	0.35
Weight mean (s.d.)	74.7 (14.6)	73.9 (14.6)	0.5[a]	0.63
BMI (>25)	61.5	58.4	0.3[b]	0.57
Gender: males	60.3	49.4	3.6[b]	0.057
Angina	16.9	7.5	8.8[b]	0.003
Previous MI	13.3	5.3	[c]	0.007
Hypertension	35.1	25.2	3.8[b]	0.051
Diabetes	9.0	3.9	[c]	0.03
Caucasian	100	97.6	[c]	0.26
Ever smoked	60.3	57.7	1.2[b]	0.27
Current smoker	21.3	33.2	[c]	0.12
Mean alcohol consumption units/week	6.0	7.8	1.8[d]	0.11
Systolic BP > 150 mmHg	47.4	44.1	0.4[b]	0.55
Diastolic BP > 90 mmHg	37.2	24.5	6.6[b]	0.01
Family history MI	22.7	22.5	0.001[b]	0.97
Family history hypertension	19.7	24.3	0.8[b]	0.37
Family history diabetes	18.0	18.0	0[b]	1.00
(*B*) Logistic regression model for prediction of atrial fibrillation				
Variable	***β* (SE)**	***P* value**	**Odds ratio (95% confidence interval)**	
Intercept	−11.9 (0.89)	<0.0001	–	
Age	0.53 (0.24)	<0.0001	1.13 (1.10, 1.15)	
Gender	0.12 (0.01)	0.03	1.71 (1.06, 2.74)	
Systolic BP > 150 mmHg	−0.98 (0.27)	0.0003	0.38 (0.22, 0.64)	
Diastolic BP > 90 mmHg	0.94 (0.28)	0.0007	2.55 (1.49, 4.38)	

Percentage in group shown unless indicated.
Variables considered were age, gender, body mass index (BMI), angina, hypertension, previous myocardial infarction, diabetes, ethnicity, smoking status, alcohol consumption, family history of myocardial infarction (MI), hypertension or diabetes, and systolic and diastolic blood pressure (BP). AF, atrial fibrillation; s.d., standard deviation.
[a]Two independent sample *t*-test.
[b]χ^2-test.
[c]Fisher's exact test.
[d]Mann–Whitney test.

Overall survival is shown on a Kaplan–Meier plot (*Figure 3*). A significant difference in survival was seen between the curves (log rank test $\chi^2 = 77.8$, $P < 0.001$). A Cox proportional hazards regression analysis adjusting for age and gender still gave a significant effect for AF [$P = 0.016$; hazard ratio (AF vs. sinus rhythm) = 1.57, 95% CI 1.09–2.26].

Discussion

Atrial fibrillation is associated with a striking increase in hospital activity, morbidity, and mortality related to the condition in recent years.[10,11] Secular trends show that the prevalence of AF in those in the same age group has increased in the Framingham cohort over the second-half of the twentieth century,[12] although in the Renfrew–Paisley study, this is more marked among men.[13] The prevalence figures from the present study are consistent with those from previous studies,[14] including one study from North-East England.[8] The fact that at least 65–70% of those with AF were already known to their general practitioners is also consistent with the previous findings from the North of England,[15] showing that 76% of those with AF had such a record in their general practice records.

The majority of patients identified to have AF in this study also had echocardiographic and clinical risk factors for stroke and thromboembolism. True 'lone' AF is rare in the community, where the majority of cases are found in the elderly. Although anticoagulation is strongly indicated in those with multiple risk factors, e.g. age and diabetes, the use of echocardiography to define those patients with LV systolic dysfunction may be important in refining prediction of stroke risk; after adjustment for clinical risk factors, moderate, severely impaired LV function has been shown to remain a strong predictor of stroke in patients in AF (relative risk 2.5).[16]

Among those with clinical risk factors (hypertension, angina, prior MI, and diabetes) for AF, only a minority (<10%) had AF. Of note, only 23% of those with a diagnosis of heart failure plus

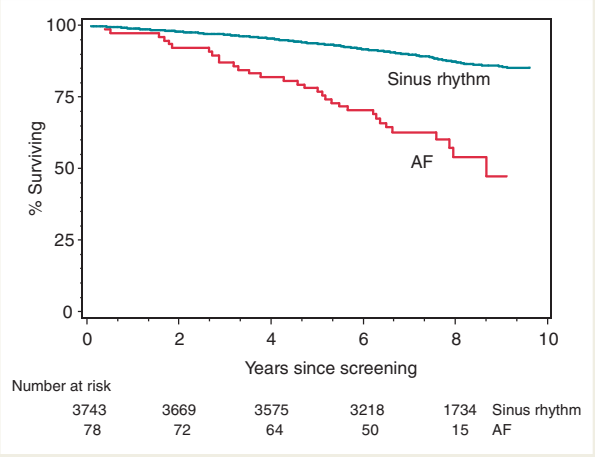

Figure 3 Kaplan–Meier survival graph for those in sinus rhythm and atrial fibrillation.

AF had definite LV systolic dysfunction. However, AF can also lead to heart failure with preserved systolic function, whereby LV diastolic dysfunction is present, especially in the setting of hypertension and coronary artery disease.

There was only a trend towards an increased prevalence of AF in those with a history of hypertension, and although a high diastolic blood pressure was a significant predictor of AF in the logistic regression model, the reverse trend was found for systolic pressure. These results do differ from those from the Framingham study,[12] where hypertension was a significant predictor for the development of AF. Indeed, the level of diurnal and nocturnal systolic blood pressure, as measured by 24-h ambulatory monitoring, independently predicts the onset of AF in hypertensive patients.[17] Hypertension also confers an additive stroke risk,[18] and uncontrolled blood pressure leads to an increased risk of bleeding. The finding that a high systolic blood pressure (>150 mmHg) at the time of clinical assessment had a negative predictive effect on likelihood of AF is somewhat counter-intuitive and surprising. Those with AF may have more advanced cardiac disease (reflected in their higher prevalence of systolic dysfunction) and be on more medication such as beta-blockers which can lower blood pressure, and the measurement of blood pressure itself may have been affected by the AF. It is likely therefore that hypertension may be a risk factor for developing AF, but that those in AF later have a lower blood pressure due to more advanced cardiac disease and treatments. A similar, initially paradoxical-seeming situation is found in heart failure.[9] Another stroke risk factor, diabetes, was shown to be significantly commoner in those in AF than in those in sinus rhythm (9.0% vs. 3.9%); it was not a significant predictor of AF in the logistic regression model.

Over half of the patients from the population sample with AF gave some indication that the condition had previously been diagnosed, but only 29.5% were receiving oral anticoagulants when seen. This figure is a little higher than the 21.4% of patients found in a smaller primary care screening study from Sheffield,[19] or the figure of 18.2% of already diagnosed cases (sustained or paroxysmal) in an Italian study.[20] Systematic screening of all the population aged 65 and older would lead to 20 newly diagnosed cases; a programme targeted on those with the risk factors would have identified 8 of these. Awareness of the benefits of anticoagulation has improved in the time since the subject assessments were carried out, so it is likely that a similar study carried out now would find more subjects receiving anticoagulants, which had been reported by others.[21]

This study is limited by its cross-sectional design, but represents one of the largest contemporary screening studies for AF in the community. The latter is important, as hospital-based studies[22] may be unrepresentative of the clinical epidemiology, given than one-third of subjects with AF have not had hospital contact.[23] Also, assessment of LV function (by echocardiography or any other method) is difficult in patients in AF, due to the great beat-to-beat variation frequently seen. This was why beats for measurement were chosen with a long R–R interval, to reflect the best function seen during the study. Nevertheless, some patients with poor ventricular rate control throughout the study may have been able to achieve a higher EF at a lower heart rate, so the estimate of patient numbers with impaired LV function may be slightly high. The screening study also depends on the patient being in AF at the time of the ECG being performed, and thus, may miss some cases of paroxysmal AF (many of whom have asymptomatic paroxysms) who happen to be in sinus rhythm at the time of screening.

Survival analysis shows that AF is associated with high mortality, an effect which remains significant even after age and sex are taken into account. The excess mortality is slightly lower than that reported in the Framingham study, where risk was approximately two-fold higher, and remained 1.5 to 1.9-fold higher even after adjustment for associated cardiovascular conditions.[12] The confidence intervals overlap, so the lower excess mortality of the ECHOES cohort may be a chance finding; however, primary care physicians were made aware of the clinical findings of ECHOES participants so it is possible that the trend to better survival may have been in part due to improvements in treatments offered to the identified subjects.

In conclusion, this epidemiological screening study has shown that the prevalence of AF is 2% among a population of 3960 subjects in primary care. This prevalence is much higher among subgroups with clinical risk factors (hypertension, MI, diabetes, and angina), and especially those with a clinical diagnosis of heart failure and if LV systolic dysfunction is present. The low prevalence of AF in younger patients without other risk factors suggests that whole population screening is not necessary, but targeted screening of older subjects with risk factors to optimize stroke prevention is likely to be beneficial. This being a study of point prevalence of the condition only, it still remains uncertain how frequently screening might be carried out.

Study limitations

Recruitment of subjects to the study was carried out in the late 1990s and, whereas the lapse of time since then has allowed survival analysis to be done, the prevalence figures are from several years ago. Awareness of the benefits of anticoagulation and the evidence base have improved since the study assessments

were done so this limits conclusions regarding the relatively low use of anticoagulation reported here.

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Conflict of interest: none declared.

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Ethics: The study complied with the Declaration of Helsinki; the research protocol was approved by the Local Research Ethics Committee for each general practice where the study was carried out, and all subjects provided written informed consent.

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