Screening to identify unknown atrial fibrillation
A systematic review

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Summary
Atrial fibrillation (AF) is associated with a significantly increased stroke risk which is highly preventable with appropriate oral anticoagulant therapy (OAC). However, AF may be asymptomatic and unrecognized prior to stroke. We aimed to determine if single time-point screening for AF could identify sufficient numbers with previously undiagnosed AF, to be effective for stroke prevention. This is a systematic review of clinical trials, by searching electronic medical databases, reference lists and grey literature. Studies were included if they evaluated a general ambulant adult population, using electrocardiography or pulse palpation to identify AF. We identified 30 individual studies (n=122,571, mean age 64 years, 54% male) in nine countries. Participants were recruited either from general practitioner and outpatient clinics (12 studies) or population screening/community advertisements (18 studies). Prevalence of AF across all studies was 2.3% (95% CI, 2.2–2.4%), increasing to 4.4% (CI, 4.1–4.6%) in those ≥65 years (16 studies, n= 27,884). Overall incidence of previously unknown AF (14 studies, n=67,772) was 1.0% (CI, 0.89–1.04%), increasing to 1.4% (CI, 1.2–1.6%) in those ≥65 years (8 studies, n= 18,189) in whom screening setting did not influence incidence identified. Of those with previously unknown AF, 67% were at high risk of stroke. Screening can identify 1.4% of the population ≥65 years with previously undiagnosed AF. Many of those identified would be eligible for, and benefit from OAC to prevent stroke. Given this incidence, community AF screening strategies in at risk older age groups could potentially reduce the overall health burden associated with AF.

Keywords
Clinical studies, prevention, stroke/prevention

Introduction
Early identification of atrial fibrillation (AF) is emerging as a priority issue in medicine, because AF is extremely common, and is associated with poor outcomes that are highly preventable with appropriate medical treatment. Prevalence of AF increases sharply with age, affecting approximately 2% of the general population, 5.5% of those ≥65 years, and exceeding 15% for those ≥85 years (1). It is expected that overall prevalence of AF will at least double by the year 2050 (2).

AF has been shown to be associated with a 5- to 7-fold increased risk of stroke, a 3-fold increased risk of heart failure and a doubling of mortality (3), although in more recent years the excess risk of stroke has diminished due to better treatment of hypertension and more widespread use of anticoagulation (4). At least 20% of all strokes are directly attributable to AF, and in 20–45% of these AF is first diagnosed at the time of stroke (5). This is probably an underestimate because a significant proportion of cryptogenic stroke is likely due to undetected AF (6–8). Cardio-embolic strokes arising from AF are generally more severe and more often fatal (9, 10). Stroke risk increases with age, rising steeply after age 65, but stroke is highly preventable with a 66% reduction in risk following appropriate anticoagulation with warfarin compared to placebo/no treatment (11). It would be anticipated that the relative risk reduction with the novel oral anticoagulation (OAC) would be equal to or better than warfarin, as they have been shown to be either superior (Dabigatran 150 mg bd and apixaban) (12, 13) or non-inferior (Dabigatran 110 mg bd and Rivaroxaban) (12, 14) to warfarin in clinical trials, although none have been compared to placebo/no treatment.

AF is asymptomatic in approximately one third (7) and a large percentage have atypical symptoms (including dyspnoea, dizziness or fatigue), especially in those ≥65 years (15). This increases the likelihood that AF will remain unrecognized prior to stroke as patients are unlikely to present to their general practitioner (GP). Those with asymptomatic AF may be up to three times more likely...
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To sustain a stroke prior to AF diagnosis (15), and have CHADS$_2$/CHA$_2$DS$_2$-VASc scores high enough to warrant consideration of OAC (16, 17).

The challenge therefore is to identify people with asymptomatic AF prior to occurrence of stroke. To accomplish this, the latest European Society of Cardiology (ESC) guidelines for management of AF recommend opportunistic screening for people ≥65 years using pulse palpation followed by 12-lead electrocardiogram (ECG) (18). To assess feasibility of more widespread screening requires knowledge of the prevalence of undiagnosed AF. Therefore, the aim of this systematic review was to: determine the overall prevalence of AF and incidence of unknown AF identifiable by single time-point screening using either ECG or pulse palpation; examine if screening setting influences the incidence of unknown AF; compare unrestricted screening to restriction to those ≥65 years; and examine stroke risk and eligibility for treatment in those with previously undiagnosed AF.

Methods

Review search strategy

Relevant studies were identified by searching multiple databases including the Current Controlled Trials register, MEDLINE (1950-June 2012); EMBASE (1966-June 2012); PEDro (to June 2012); Clinical evidence (2001–June 2012); Evidence Based Medicine search (to June 2012) and the Cochrane Library (to June 2012). The search included reference lists, conference lists, grey literature and keyword internet searching. Keyword search terms were atrial fib, SUuddation OR atrial flutter AND screening OR detection OR identification OR diagnosis OR sensitivity OR specificity OR mass screening OR case finding AND ECG OR EKG OR electrocard* OR pulse*.

Trial selection

Two independent reviewers (NL, LN) scanned titles and abstracts and identified potentially relevant articles. Studies were considered relevant if they screened a general ambulatory population, using either pulse palpation or ECG to identify AF; and screened on only one occasion, or reported prevalence/incidence of AF identified from baseline screening. Studies were excluded if they screened populations with specific co-morbidities such as stroke, hypertension or cardiac disease, if they utilised ambulatory or Holter ECG, or screened at multiple time points to determine the prevalence/incidence of AF.

Primary outcomes were prevalence of AF (in AF at time of screening) and incidence of previously undiagnosed AF. Secondary outcomes were reported stroke risk scores (i.e. CHADS$_2$ or CHA$_2$DS$_2$-VASc) and eligibility for stroke thromboprophylaxis.

**Figure 1: Study selection.**

[Diagram showing the study selection process with the number of studies at each stage: 9,536 identified from database searching, 9584 after duplicates removed, 9,419 excluded based on inclusion/exclusion criteria, 165 full text manuscripts reviewed, and 30 included in the final analysis.]
Full-text manuscripts were obtained for all relevant studies. Quality of reporting of all studies was assessed according to the STROBE checklist (19). Risk of bias in individual studies was assessed using STROBE checklist items.

**Data collection process**

All outcome data were extracted independently by NL and LN. Any disagreement between reviewers was resolved by a third reviewer (SBF). Data were collected on a data-extraction form and included patient demographics, description of the screening program and clinical outcomes (prevalence of known AF, incidence of previously unknown AF and calculated stroke risk). Where data were not reported, the primary study authors were contacted.

**Data synthesis and analysis**

The references and abstracts identified from the search were imported into Endnote X4 bibliographic software and duplicates removed. Where papers about the same study reported outcomes at different time points, the longest follow-up point was used. Prevalence and incidence were calculated using binomial confidence intervals. Sub-group analysis using Pearson's Chi-square were used to compare differences in prevalence/incidence between unrestricted screening versus screening those ≥65 years, and screening in a population/community setting versus screening in a GP/outpatient clinic setting.

**Results**

**Study selection and characteristics**

A total of 9,584 studies were screened against the inclusion and exclusion criteria and 165 full manuscripts reviewed. Cohen's kappa (κ) coefficient for inter-rater agreement measured κ = 0.88 for stage one of study selection and κ = 0.94 for stage two. Thirty unique studies (n=122,571 patients) were ultimately included (Figure 1).

The 30 studies were of mixed designs from nine countries, including 26 prospective cohort studies (1, 17, 20-43), two retrospective cohort studies (16, 44) and two randomised controlled trials both comparing opportunistic with systematic screening (45, 46) (Table 1). Participants were recruited from either GP or outpatient clinics (12 studies), (16, 20-27, 44-46) or community advertisements or population screening (18 studies) (1, 17, 28-43).

The total number of participants was 122,571: 54% male (reported in only 21 studies) (1, 16, 17, 20-23, 27-32, 34-40, 42-46), with mean age of 64 years (reported in only 14 studies) (1, 16, 17, 20-22, 28-30, 35, 36, 38, 45, 46) although mean age is likely an overestimate as age range was generally lower in the studies not reporting mean age. The lower age limit for recruitment varied widely across studies with only 14 studies limiting recruitment to participants ≥65 years (17, 20, 23-27, 37, 38, 41, 43-46). Apart from age range, inclusion and exclusion criteria were similar between studies, with the key reason for exclusion being cognitive or terminal illness (e.g. cancer). Screening methods differed between studies: the majority used ECG (1, 16, 17, 21, 22, 24-35, 37-44), three pulse palpation (20, 23, 34), and two a combination of these (45, 46). Screening results are outlined in Table 1.

**Quality assessment**

Overall quality of study reporting was moderate, according to STROBE checklist (see Suppl. Table 1, available online at www.thrombosis-online.com). Risk of bias within studies was moderate: 16 studies did not fully describe characteristics of study participants (23-27, 31, 33-37, 39-43); 11 did not outline study limitations (1, 16, 21, 23, 25, 27, 31, 41-44); 12 did not discuss external validity of results; and only three studies outlined efforts to address potential study bias (17, 31, 45); one study limited recruitment to males only (40) and another study limited recruitment to South-Asian or Afro-Caribbean race only (22).

**Quantitative data synthesis**

**Prevalence of AF**

The overall prevalence of AF from all studies was 2.3% (95% confidence interval [CI], 2.2-2.4%) (Table 2). The prevalence was higher in the GP/outpatient clinic setting (3.6%), than in the community setting (1.9%, p<0.001). However, the age range of participants in the community setting was generally younger and may partially explain the observed difference. When screening was limited to those ≥65 years (16 studies, n=27,884) (16, 17, 20, 23-27, 29, 37, 38, 41, 43-46), AF prevalence increased from 2.3 to 4.4% (CI, 4.1-4.6%) (Table 2). Observed prevalence was again higher at 4.6% in the GP/outpatient clinic setting, compared to 4.0% in the community setting (p=0.009).

**Previously undiagnosed AF**

The incidence of previously undiagnosed AF was 1.0% (CI, 0.89-1.04%) (14 studies, n=67,772) (16, 17, 20, 24, 25, 29-32, 34, 36, 38, 45, 46) (Table 3). Incidence was again significantly higher in the GP/outpatient clinic setting than the community setting (1.2% vs 0.9%, p<0.001), again explained in part by the younger age of subjects in community studies. When screening was limited to participants ≥65 years (8 studies, n=18,189) (16, 17, 20, 24, 25, 38, 45, 46), the incidence of previously undiagnosed AF increased significantly to 1.4% (CI, 1.2-1.6%), and did not differ between screening settings (Table 3).

**Stroke risk**

Stroke risk and medication status for those with previously known AF were reported in seven studies (n=49,041) (16, 24, 25, 29-31, 46). 59% were at high risk of stroke, assessed as being eligible for OAC; four studies defined high risk as CHADS2≥2 (16, 29-31), two studies based this on physician opinion (24, 25) and one was based on the presence of an additional stroke risk factor in patients ≥65 years.
Table 1: Study characteristics and outcomes.

<table>
<thead>
<tr>
<th>Author; Year</th>
<th>Country</th>
<th>Study design; Systematic vs opportunistic</th>
<th>Pulse palpation vs ECG</th>
<th>Participant numbers</th>
<th>Targeted age (years)</th>
<th>Mean age (±SD)</th>
<th>Male (%)</th>
<th>Total prevalence AF (%)</th>
<th>Previously unknown AF (%)</th>
<th>Known AF eligible for OAC (%)</th>
<th>Number taking OAC (%)</th>
<th>Previously unknown AF eligible for OAC (%)</th>
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<tbody>
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<td>Spain</td>
<td>Prospective; Systematic</td>
<td>Pulse palpation</td>
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<td>44</td>
<td>4.1</td>
<td>1.1</td>
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<td>Gomez-Doblas et al; 2012 (21)</td>
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<td>Prospective cross-sectional; Systematic</td>
<td>12-lead ECG</td>
<td>6566</td>
<td>≥40</td>
<td>60±13</td>
<td>46</td>
<td>3.8</td>
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<td>Deif et al; 2012 (16)</td>
<td>Australia</td>
<td>Retrospective ECG review; Systematic</td>
<td>12-lead ECG</td>
<td>2802</td>
<td>≥40</td>
<td>65±13</td>
<td>50</td>
<td>4</td>
<td>6.7†</td>
<td>0.4</td>
<td>80/100† (80)</td>
<td>72/80 (58)</td>
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<td>Prospective cross-sectional; Systematic (South-Asian or Afro-Caribbean race only)</td>
<td>12-lead ECG</td>
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<td>61±11†</td>
<td>47†</td>
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<td>Pulse + 12-lead ECG; vs pulse palpation⁴</td>
<td>2357†</td>
<td>≥65</td>
<td>75±7</td>
<td>43</td>
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<td>4.3†</td>
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<td>Randomised controlled trial; Systematic vs opportunistic</td>
<td>Pulse + 12-lead ECG; vs pulse palpation⁴</td>
<td>1099†</td>
<td>≥65</td>
<td>74</td>
<td>43†</td>
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<td>12-lead ECG</td>
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<td>3.7</td>
<td>1.2</td>
<td>16/20a (80)</td>
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<td>--</td>
<td>6/10a (60)</td>
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<td>9</td>
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<td>Author; Year</td>
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<td>Male (%)</td>
<td>Total prevalence AF (%)</td>
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<td>Known AF eligible for OAC (%)</td>
<td>Number taking OAC n (%)</td>
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<td>2254</td>
<td>≥65</td>
<td>38</td>
<td>2.3</td>
<td>2</td>
<td>3</td>
<td>1.2</td>
<td>46/81b (57)</td>
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<td>12-lead ECG</td>
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<td>≥71</td>
<td>64</td>
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<td>1</td>
<td>1</td>
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<td>Community/population studies</td>
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<td>Prospective population screen; Systematic</td>
<td>12-lead ECGb</td>
<td>848b</td>
<td>75–76b</td>
<td>75</td>
<td>43b</td>
<td>10.7b</td>
<td>1.2b</td>
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<td>46/81b (57)</td>
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<td>Australia</td>
<td>Prospective community screen; Opportunistic</td>
<td>12-lead ECG</td>
<td>1951</td>
<td>&gt;18</td>
<td>57 ± 14</td>
<td>43</td>
<td>1.9</td>
<td>1</td>
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<td>132/228c (58)</td>
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<td>Claes et al; 2012 (29)</td>
<td>Belgium</td>
<td>Prospective community screen; Opportunistic</td>
<td>Handheld lead-1 ECG (Omron HCG-801)</td>
<td>10,758</td>
<td>≥40</td>
<td>59 ± 11</td>
<td>38</td>
<td>2.1</td>
<td>1.5</td>
<td>94/161c (58.7)</td>
<td>60/94 (64)</td>
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<td>Prospective population screen; Systematic</td>
<td>12-lead ECG</td>
<td>5000</td>
<td>35–74</td>
<td>52 ± 11</td>
<td>49.9</td>
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<td>0.5</td>
<td>225/409c (55)</td>
<td>105/130 (80)</td>
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<td>Prospective population screen; Systematic</td>
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<td>45</td>
<td>1.5</td>
<td>0.6</td>
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<td>Doliwa et al; 2009 (32)</td>
<td>Sweden</td>
<td>Prospective community screen; Opportunistic</td>
<td>Handheld lead-1 ECG (Zenicor)b</td>
<td>606b</td>
<td>&gt;18b</td>
<td>64b</td>
<td>2b</td>
<td>1b</td>
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<td>Heeringa et al; 2006 (1)</td>
<td>Netherlands</td>
<td>Prospective population screen; Systematic</td>
<td>12-lead ECG</td>
<td>6808</td>
<td>&gt;55</td>
<td>69 ± 9</td>
<td>40.5</td>
<td>3</td>
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</table>
Stroke risk for previously unknown AF was reported in only four studies (16, 17, 24, 25) (n=5,676), only two of which calculated CHADS$_2$ or CHA$_2$DS$_2$-VASc scores (16, 17). Mean (± standard deviation [SD]) reported CHADS$_2$ scores were 1.9 ± 1.5 (increasing to 2.2 ± 1.5 in those ≥65 years) (16) and 1.8 (SD not reported) (17); mean CHA$_2$DS$_2$-VASc was 3.3 ± 2.2 (increasing to 3.8 ± 2.0 in those ≥65 years) (16). Additionally, from the three studies that reported OAC eligibility (16, 24, 25), 67% (18 of 27 subjects) identified with previously unknown AF were eligible for OAC. However, only 64% of those eligible for stroke prevention were prescribed OAC, consistent with the known evidence-treatment gap (47).
OAC; one study calculated high risk as CHADS2≥2 (16), and two studies based risk on physician opinion without presentation of stroke risk scores (24, 25).

**Discussion**

We found single time-point screening identifies an overall AF prevalence of 2.3%, and 4.4% in those ≥65 years. These figures are similar to larger epidemiology studies investigating prevalence of AF (2). This high prevalence impacts as a large and escalating health and economic burden of AF to the community, especially in the elderly (2). Most importantly, we found a 1% incidence of previously undiagnosed AF (45, 46), guidelines do not as yet recommend widespread population screening in addition to opportunistic and systematic screening identify similar numbers using opportunistic screening in people ≥65 years. These figures are most recent data point (1987–1999) reported in this review.

In the limited studies where symptomatic status was investigated, only 20% with newly diagnosed AF reported palpitations (16) and the majority did not have an elevated heart rate (16, 29). These results mirror studies monitoring patients post-cryptogenic stroke, which identified many with newly diagnosed paroxysmal AF, of whom only 6% were symptomatic (6). In studies investigating atrial tachyarrhythmia detected through continuous recording in patients with pacemakers, even brief periods of subclinical tachyarrhythmias were common and associated with a 2.5-fold increased stroke risk, independent of other risk factors (7). It is therefore unlikely that such individuals will be identified on the basis of symptoms.

As the risk of stroke, myocardial infarction and all-cause mortality has been shown to be highest within months of initial AF diagnosis (48) potentially due to a long prior asymptomatic risk period, early diagnosis is important and is now recommended in the ESC guidelines via opportunistic screening in a medical setting (18). The Royal College of Physicians of Edinburgh have also recently recommended a national screening program in the UK using opportunistic screening in people ≥65 years (49). Although opportunistic and systematic screening identify similar numbers of previously undiagnosed AF (45, 46), guidelines do not as yet recommend widespread population screening in addition to opportunistic clinical screening to reduce stroke occurrence as the first manifestation of AF. Consideration of this strategy may be warranted given the lack of symptoms which would lead to a medical consultation in patients with unknown AF.

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**Table 1: Continued**

<table>
<thead>
<tr>
<th>Author; Year</th>
<th>Country</th>
<th>Study design; Systematic vs opportunistic</th>
<th>Pulse-palpation vs ECG</th>
<th>Participant numbers</th>
<th>Targeted age (years)</th>
<th>Mean age (± SD)</th>
<th>Male (%)</th>
<th>Total prevalence AF (%)</th>
<th>Previously unknown AF (%)</th>
<th>Known AF eligible for OAC (%)</th>
<th>Number taking OAC (%)</th>
<th>Previously unknown AF eligible for OAC (%)</th>
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<tr>
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<td>England</td>
<td>Prospective population screen (males only); Systematic</td>
<td>Limb-lead ECG</td>
<td>18403</td>
<td>40–65</td>
<td>–</td>
<td>100</td>
<td>0.4</td>
<td>11.3†</td>
<td>–</td>
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<td>Mihalick et al; 1974 (41)</td>
<td>USA</td>
<td>Prospective; Systematic</td>
<td>12-lead ECG</td>
<td>671</td>
<td>&gt;65</td>
<td>–</td>
<td>–</td>
<td>5</td>
<td>–</td>
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<td>&gt;16</td>
<td>–</td>
<td>48</td>
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<td>Eliazer et al; 1941 (43)</td>
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<td>Prospective; Systematic</td>
<td>3-lead ECG</td>
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<td>68</td>
<td>3</td>
<td>–</td>
<td>–</td>
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<td>–</td>
</tr>
</tbody>
</table>

†Systematic group; ‡Opportunistic group; †Cohort limited to ≥65 years; ††Cohort limited to ≥60 years; †Data provided by authors; †Only data pertaining to single time-point screening section of this study is reported in this review; OAC – oral anticoagulants; Calculated as CHADS2 score ≥2; Calculated according to physician opinion; ††Calculated as having an additional stroke risk factor; †Most recent data point (1987–1999) reported in this review.

\[ \text{CHADS2 score} = \left( \frac{\text{Congestive heart} + \text{Hypertension} + \text{Diabetes} + \text{Stroke or TIA}}{2} \right) \]

\[ \text{DS} = \left( \frac{\text{Age} \times \text{Number of atrial fibrillation cycles}}{2} \right) \]

\[ \text{VASc score} = \left( \frac{\text{Valvular heart disease} + \text{Hypertension} + \text{Age} + \text{Diabetes} + \text{Stroke or TIA}}{2} \right) \]
Cost must also be considered when determining the scope of potential screening programs. Economic analyses have concluded cost-effectiveness for annual screening (50) and opportunistic screening (51), using 12-lead ECG in those ≥65 years. However, given the high incidence of unknown AF identified with screening programs, the high proportion with unknown AF who are asymptomatic, and the high cost of the large strokes which may complicate undetected AF, systematic population screening may be preferable if shown to be cost-effective.

Alternate methods of screening using new technology may warrant consideration, such as handheld ECGs (29, 32, 52), blood pressure machines (53) and finger-probe instruments (54). These devices have reported sensitivity to detect AF in the range of 95-98% and specificity in the range of 86-97% (32, 52-54), compared to pulse palpation sensitivity of 94% (95% CI, 84-97%) and specificity of 72% (95% CI, 69-75%) (55). We recently showed that an iPhone ECG device had 98% sensitivity and 97% specificity for automated diagnosis of AF; with a k value of 0.92 against 12-lead ECG (52). These new technologies are quick and simple to use and low cost to administer, presenting feasible alternatives to pulse check and 12-lead ECG for AF screening. Although no cost analysis of these technologies has been performed, it is likely they would be more cost-effective than 12-lead ECG alone; and more cost-effective than pulse palpation followed by 12-lead ECG, as higher specificity may reduce the number of 12-lead ECGs required thereby reducing cost. It is therefore probable that systematic screening of those ≥65 years, using novel technologies would be a viable alternative (52, 56).

Our review focussed on a single time-point for screening as this may provide a practical solution for future population screening programmes. Studies that screen at multiple time points, or assess rhythm over an extended period have been shown to identify a higher incidence of paroxysmal AF (6, 7, 17, 57). Paroxysmal AF is more problematic to identify with single time-point screening, as patients may be in sinus rhythm when screened. This was seen in the recent Swedish study of 75-year-olds, where a single ECG showed an incidence of unknown AF of 1.2%, rising to 7.4% with extended handheld, Holter or event recording (17). Nevertheless, the incidence identified in this review from a once-only screen, is probably high enough to support the use of single time-point screening. Not surprisingly, incidence is dependent on age of the screened population, with larger yields occurring in those ≥65 years.

The 2012 ESC guidelines advocate a practice shift towards identification of truly ‘low risk’ patients (age <65 years and lone AF), or CHA2DS2-VASc=0 (18), as CHADS2-VASc=0 is no longer considered ‘low risk’ (58). Age alone is a risk factor for stroke, with CHA2DS2-VASc score allocating one point for age ≥65 years alone and an additional point if aged ≥75 years (18). Additional risk factors for stroke also increase with age and initially low risk patients (those with a CHA2DS2-VASc score of 0) can accumulate risk fac-

### Table 2: Prevalence of atrial fibrillation.

<table>
<thead>
<tr>
<th>Total cohort</th>
<th>≥65 years</th>
<th>65 years or ≥65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of studies</td>
<td>Number of participants</td>
<td>% AF identified (95% CI)</td>
</tr>
<tr>
<td>All settings</td>
<td>30</td>
<td>2.3% (2.2 – 2.4)</td>
</tr>
<tr>
<td>GP/Outpatient clinic</td>
<td>12</td>
<td>3.6% (3.4 – 3.8)</td>
</tr>
<tr>
<td>Community</td>
<td>18</td>
<td>1.9% (1.8 – 2.0)</td>
</tr>
</tbody>
</table>

* p<0.001; † p=0.009.

### Table 3: Previously unknown atrial fibrillation identified.

<table>
<thead>
<tr>
<th>Total cohort</th>
<th>≥65 years</th>
<th>65 years or ≥65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of studies</td>
<td>Number of participants</td>
<td>% AF identified (95% CI)</td>
</tr>
<tr>
<td>All settings</td>
<td>14</td>
<td>1.0% (0.9 – 1.0)</td>
</tr>
<tr>
<td>GP/Outpatient clinic</td>
<td>5</td>
<td>1.2% (1.1 – 1.4)</td>
</tr>
<tr>
<td>Community</td>
<td>8</td>
<td>0.9% (0.8 – 1.0)</td>
</tr>
</tbody>
</table>

* p<0.001; † p = not significant = 0.7.
tors over time (59). Once identified, those with CHA2DS2-VASc≥2 should be considered for OAC (18), including the option of new OACs which have a net clinical benefit for those with a CHA2DS2-VASc score ≥1 (60). Thus, screening those <65 years may not be cost-effective as yield would be lower, and most would not need treatment.

The main limitation of this review is the quality of reporting in many of the studies. Mean age was often not reported, and as participant age directly affects prevalence and incidence, comparison of results between settings was difficult. Also, the majority of studies did not identify whether AF was known, therefore calculation of incidence of previously unknown AF was possible from only 13 studies, only two of which reported incidence in those ≥65 years in a community setting. Additionally, the majority of studies did not calculate or report stroke risk and only four reported stroke risk in previously unknown AF.

Conclusions

The findings of this systematic review indicate that single time-point screening in people aged ≥65 years identifies previously unknown AF in 1.4%, regardless of screening setting. This is substantial, considering that the majority of those identified have sufficiently high stroke risk to benefit from thromboprophylaxis. Identification of AF through widespread screening could reduce the stroke burden associated with undiagnosed AF. The observed incidence coupled with the ease of use of novel technologies, such as handheld ECG, may facilitate implementation of systematic community screening targeted at those ≥65 years in addition to the opportunistic clinic ascertainment envisaged in current guidelines. Further research using new technologies is warranted to determine their feasibility and cost-effectiveness for large-scale screening.

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Conflicts of interest

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References