Clinical Predictors of Risk for Atrial Fibrillation: Implications for Diagnosis and Monitoring

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Abstract

Objective: To create a risk score using clinical factors to determine whom to screen and monitor for atrial fibrillation (AF).

Patients and Methods: The AF risk score was developed based on the summed odds ratios (ORs) for AF development of 7 accepted clinical risk factors. The AF risk score is intended to assess the risk of AF similar to how the CHA2DS2-VASc score assesses stroke risk. Seven validated risk factors for AF were used to develop the AF risk score: age, coronary artery disease, diabetes mellitus, sex, heart failure, hypertension, and valvular disease. The AF risk score was tested within a random population sample of the Intermountain Healthcare outpatient database. Outcomes were stratified by AF risk score for OR and Kaplan-Meier analysis.

Results: A total of 100,000 patient records with an index follow-up from January 1, 2002, through December 31, 2007, were selected and followed up for the development of AF through the time of this analysis, May 13, 2013, through September 6, 2013. Mean ± SD follow-up time was 3106 ± 819 days. The ORs of subsequent AF diagnosis of patients with AF risk scores of 1, 2, 3, 4, and 5 or higher were 3.05, 12.9, 22.8, 34.0, and 48.0, respectively. The area under the curve statistic for the AF risk score was 0.812 (95% CI, 0.805-0.820).

Conclusion: We developed a simple AF risk score made up of common clinical factors that may be useful to possibly select patients for long-term monitoring for AF detection.

Atrial fibrillation (AF) affects 2.3 million Americans, is associated with an increased risk of stroke, and often occurs with other comorbidities, such as congestive heart failure.¹,² Although anticoagulation can reduce the risk of stroke, anticoagulation can only be initiated if the diagnosis of AF is made. Because AF is often asymptomatic, it is frequently undiagnosed, and patients therefore do not undergo anticoagulation. As a consequence, these patients may be exposed to a higher risk of stroke.³,⁴ This potential adverse risk is highlighted in a study that found that subclinical AF accounted for approximately 23% of cryptogenic strokes.⁵ In addition, addressing AF may also positively affect other associated comorbidities.

Atrial fibrillation, especially if paroxysmal and asymptomatic, may be missed during clinical evaluations, electrocardiography, and periodic ambulatory telemetry monitoring. Screening for AF after an ischemic stroke has the anticipated benefit of identifying 4.4 new cases of AF for every 100 patients monitored.⁶ With long-term continuous monitoring, as is available with implantable devices, the diagnostic yield of previously undetected AF after a stroke increases significantly.⁷ Expansion of long-term monitoring to detect AF before a stroke occurs in large populations is not likely to be cost-effective or time effective, unless high-risk features for AF genesis can be determined to improve selection criteria. In addition, data from the Asymptomatic Atrial Fibrillation and Stroke Evaluation in Pacemaker Patients and the Atrial Fibrillation Reduction Atrial Pacing Trial (ASSERT) suggest that strokes often occur independently of AF episodes, and as such remote monitoring as a means to detect AF early and reduce events by starting anticoagulation may be insufficient.⁸ As such, we sought to create a simple, readily accessible AF risk score according to general clinical markers to determine which patients are at highest risk of AF and should be considered for long-term monitoring.
monitoring to improve early diagnosis and initiate anticoagulation strategies.

METHODS

Risk Score Basis

Initial analysis was performed on the basis of literature cited in the review by Kirchhof et al. Kirchhof et al summarized data from a variety of previously published studies in regard to risk factors for AF that they further classified as validated. The validated risk factors for AF defined by Kirchhof et al included age, coronary artery disease, diabetes mellitus, sex, heart failure, hypertension, and valvular disease. To establish their validated AF risk factors, Kirchhof et al cited a total of 17 publications as sources, of which 16 were included in their risk score development meta-analysis (1 publication was excluded because all patients had AF and, therefore, could not contribute to attempts to build discriminatory models). Data from each of the 16 source documents were extracted to derive validated risk factors for AF.

Because some of these source documents presented results from a series of statistical models adjusted for different factors, we selected the simplest model presented to eliminate problems of interpretation by combining models from different covariate adjustments and to produce meta-analytic estimates closest to the aggregate unadjusted result. Odds ratios (ORs) were used if multiple metrics were presented or raw summary statistics were available. When necessary, relative risks and hazard ratios were presumed to approximate the OR to facilitate modeling. To allow for heterogeneity among studies, a random-effects meta-analysis was performed by analyzing the log ORs via restricted maximum likelihood estimation. A separate model was fit for each risk factor, with potentially different studies being included in each model, depending on the risk factor data available in the source publication.

When multiple cohorts were presented in an article, each cohort was considered as its own independent study and not combined within a publication. When not previously defined by the source article, we defined hypertension as systolic blood pressure greater than 160 mm Hg. Odds of AF according to age were calculated for 3 age strata: younger than 65, 65 through 75, and older than 75 years.

Risk Score Development

A risk score for the development of AF was created with the point estimates for the OR of each factor from the random-effects meta-analysis. Risk score points were assigned to each of the 7 risk factors with downward rounding of their respective meta-analytic ORs. The presence of each risk factor provides a contribution to the total risk score.

The meta-analysis of the 16 studies used to develop the AF risk score is summarized in Table 1. The ORs ranged from 1.5 for male sex to 3.6 for heart failure. For each risk factor, there was significant evidence of heterogeneity (all \( P < .02 \)), and the percentage of total variability due to heterogeneity ranged from 63.9% to 91.2% (for valvular disease and hypertension, respectively), supporting the use of a random-effects model. There was significant evidence of heterogeneity for all risk factors (Cochran Q ranging from 12.0 for valvular disease to 157.6 for hypertension; \( P < .02 \) for all risk factors), validating the choice of a random-effects model.

The AF risk score contributions were as follows: 3 points for the presence of heart failure, 2 points each for the presence of valvular disease or

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>No. of patients included in analysis</th>
<th>Meta-analytic odds ratio (95% CI)</th>
<th>AF risk score contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart failure</td>
<td>65,074</td>
<td>3.6 (2.7-4.7)</td>
<td>3</td>
</tr>
<tr>
<td>Valvular disease</td>
<td>14,880</td>
<td>2.4 (1.8-3.2)</td>
<td>2</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>57,516</td>
<td>2.1 (1.6-2.9)</td>
<td>2</td>
</tr>
<tr>
<td>Age (per 10 years)</td>
<td>44,690</td>
<td>2.1 (1.9-2.4)</td>
<td>1 (aged 65-75 years) or 2 (aged &gt;75 years)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>112,364</td>
<td>1.6 (1.4-1.9)</td>
<td>1</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>69,739</td>
<td>1.6 (1.4-1.8)</td>
<td>1</td>
</tr>
<tr>
<td>Sex (male)</td>
<td>63,164</td>
<td>1.5 (1.2-1.8)</td>
<td>1</td>
</tr>
</tbody>
</table>

*P<.001 for all
coronary artery disease, and 1 point each for the presence of hypertension, diabetes, or male sex. To capture age reported as a continuous risk factor and to allow practical scoring for age, 2 points were assigned for those older than 75 years and 1 point for those aged 65 through 75 years. Patients were assigned a score by adding the appropriate number of points, depending on the risk factors present. As a result, patients were stratified according to an AF risk score, ranging from a low of 0 to a high of 12.

The literature review and AF risk score development were performed from July 21, 2011, through September 9, 2011.

**Risk Score Validation**

From May 13, 2013, through September 6, 2013, this AF risk score was prospectively and independently validated against a large medical system’s database of 100,000 randomly selected outpatients seen from January 1, 2002, through December 31, 2007, from the Intermountain Healthcare Hospitals and network after institutional review board approval. Twenty-four of these patients were removed from the analysis because their sex was not being available in their respective records. For the remaining patients, clinical variables based on both inpatient and outpatient clinical visits, including age, sex, heart failure, significant valvular disease, coronary artery disease (including myocardial infarction history), hypertension diagnosis, systolic blood pressure greater than 160 mm Hg, diabetes, hyperlipidemia, renal failure, and cerebral vascular accident history, were extracted for analysis. Another 2067 patients were excluded because they had a prior diagnosis of AF. The patients’ subsequent AF status was determined by searching the hospital discharge summary for diagnostic (International Classification of Diseases, Ninth Revision [ICD-9]) codes for AF at index and previous admissions to Intermountain Healthcare hospitals and clinic visits and by searching the system-wide electrocardiographic database. These databases are updated daily with completion of the dictated medical reports and physician review of the ordered electrocardiograms and ambulatory monitors.

For validation, the AF risk score for each patient was calculated on the basis of the index visit and the distribution of the development of AF by levels of the AF risk score. From this, the empirical odds of AF were calculated from logistic regression models by comparing the higher levels of risk score to those with the reference value of zero (ie, no risk factors).

In addition, an analysis was performed to suggest a clinically useful AF risk score threshold for identifying patients at risk of developing AF. For each potential risk score threshold, all

### TABLE 2. Baseline Characteristics of the Patient Population

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Overall</th>
<th>No incident AF (n=94,478)</th>
<th>Incident AF (n=3431)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD) [median], y</td>
<td>42.9 (18.5) [41.0]</td>
<td>42.0 (18.0) [40.0]</td>
<td>67.5 (13.3) [69.0]</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Age categories (y)</td>
<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>&lt;65</td>
<td>83,409 (85.2)</td>
<td>82,193 (87.0)</td>
<td>1216 (35.4)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>65-75</td>
<td>8765 (9.0)</td>
<td>7550 (8.0)</td>
<td>1215 (35.4)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>&gt;75</td>
<td>5735 (5.9)</td>
<td>4735 (5.0)</td>
<td>1000 (29.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sex (male)</td>
<td>39,682 (40.5)</td>
<td>37,937 (40.2)</td>
<td>1754 (50.9)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Hypertension (clinical diagnosis)</td>
<td>12,592 (12.9)</td>
<td>11,083 (11.7)</td>
<td>1509 (44.0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>SBP &gt;160 mm Hg</td>
<td>2818/70,720 (2.9)</td>
<td>2604/67,490 (3.9)</td>
<td>214/3230 (6.6)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Hypertension (clinical diagnosis) or SBP &gt;160 mm Hg</td>
<td>14,434 (14.7)</td>
<td>12,835 (13.6)</td>
<td>1599 (46.6)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>9850 (10.1)</td>
<td>8802 (9.3)</td>
<td>1048 (30.5)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>5510 (5.6)</td>
<td>4867 (5.2)</td>
<td>643 (18.7)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>3522 (3.6)</td>
<td>2866 (3.0)</td>
<td>656 (19.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Renal failure</td>
<td>531 (0.5)</td>
<td>466 (0.5)</td>
<td>65 (1.9)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Heart failure</td>
<td>1473 (1.5)</td>
<td>1152 (1.2)</td>
<td>321 (9.4)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Myocardial Infarction history</td>
<td>812 (0.8)</td>
<td>671 (0.7)</td>
<td>141 (4.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Cerebral vascular accident history</td>
<td>307 (0.3)</td>
<td>263 (0.3)</td>
<td>44 (1.3)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Significant valvular heart disease</td>
<td>1134 (1.2)</td>
<td>942 (1.0)</td>
<td>192 (5.6)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*AF = atrial fibrillation; SBP = systolic blood pressure.  
Results are presented as No. (percentage) of patients unless otherwise indicated.  
Used for AF risk score validation.
patients were classified on the basis of the incidence of AF as the reference and the risk score as the predictive measure. From these classifications, the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were calculated. Data analyses were performed with R Language, using the metafor package, and SPSS statistical software, version 21 (SPSS Inc).

RESULTS

Risk Score Validation

Records of 97,909 patients were studied to assess their subsequent incidence of AF. The mean ± SD follow-up for vital status was 3106±819 days. Patient characteristics by incident AF status are summarized in Table 2.

Patients who developed AF were older and had higher rates of hypertension, diabetes, coronary artery disease, heart failure, prior stroke, and renal failure. The incidences and ORs for incident AF are listed in Table 3. There was an independent association with each AF risk score and incident AF. Furthermore, there was a nonlinear augmentation of risk with the addition of each stratum of the AF risk score. The Figure shows the Kaplan-Meier survival analysis for freedom from AF separated by AF risk score category. The area under the curve statistic is 0.812 (95% CI, 0.805-0.820).

The performance of the AF risk score was calculated for each score as a threshold of predicting AF and is presented in Table 4. For example, an AF risk score of 2 or greater yields a 70.8% sensitivity, 82.4% specificity, and 82.0% accuracy.

DISCUSSION

The current study has several important findings relevant to the epidemiology and risk stratification of AF and the related comorbidity of stroke. First, incident AF is common in patients with coexistent cardiovascular disease, and the risk does not diminish over time. Second, risk factors across a broad spectrum of studies can be used to determine incident AF risk and create a risk rule. These risk factors are common in the general population and as such have applicability to community care paradigms. For example, in this study, 90.8% of patients who developed AF had a least 1 risk factor, 70.8% had 2 or more, and 48.4% had 3 or more. Third, the risk rule developed herein revealed independent and incremental value in predicting incident AF in a large population of patients with no prior history of arrhythmia.

We believe that this score not only will identify patients at risk of incident AF but also could enhance long-term use of monitoring devices. For example, by using an AF risk score of 2 or higher, the potential number of patients considered for long-term monitoring to detect AF would decrease from 97,909 to 19,088, with a favorable sensitivity and specificity of 70.8% and 82.4%, respectively.

Our AF risk score correlates with the CHA2DS2-VASc score, which is also a composite of cardiovascular risk factors that are used to predict stroke risk in patients with known AF. These data have significant clinical value in that those patients who have the highest risk of developing AF likely also have the highest risk of AF-related morbidity, such as stroke. Therefore, our AF risk score has practical implications in that patients screened and identified because of their high scores would likely benefit from long-term anticoagulation.

Risk stratification models, such as the one described herein, reduce the need to wait for clinical manifestations of disease before beginning preventive or treatment measures. We believe

<table>
<thead>
<tr>
<th>AF risk score</th>
<th>No. (%) of patients by AF risk score</th>
<th>Mean annual incidence of AF (%)</th>
<th>Cumulative incidence of AF, No. (%)</th>
<th>Univariable odds ratio (95% CI) (vs a score of 0)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>44,834 (45.8)</td>
<td>0.0797</td>
<td>315 (0.703)</td>
<td>1.0 [Reference]</td>
<td>1.0 [Reference]</td>
</tr>
<tr>
<td>1</td>
<td>33,987 (34.7)</td>
<td>0.241</td>
<td>687 (2.02)</td>
<td>3.05 (2.67-3.49)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>2</td>
<td>9333 (9.5)</td>
<td>1.03</td>
<td>767 (8.22)</td>
<td>12.9 (11.4-14.8)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>3</td>
<td>4843 (4.9)</td>
<td>1.81</td>
<td>640 (13.2)</td>
<td>22.8 (19.9-26.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>4</td>
<td>1943 (2.0)</td>
<td>2.69</td>
<td>364 (18.7)</td>
<td>34.0 (29.2-39.5)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>≥5</td>
<td>2969 (3.0)</td>
<td>3.76</td>
<td>658 (22.2)</td>
<td>48.0 (41.9-54.9)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

AF = atrial fibrillation.
This is of utmost importance because waiting for AF to develop and be sustained to a level believed to be associated with stroke in the TRENDS study would not be helpful in preventing most strokes. Early diagnosis of AF in general is challenging. Many patients will not be diagnosed as having AF until they experience significant symptoms, such as palpitations, shortness of breath, or chest discomfort, that prompt the initiation or repetitive use of diagnostic tools to diagnose arrhythmia. As mentioned previously, however, symptoms alone that prompt clinical presentation are a poor indicator of AF because approximately one-fourth to one-third of patients will not experience symptoms during their AF episodes.\(^{29-31}\) Unfortunately, asymptomatic patients share the same risk of stroke as those with symptomatic episodes.\(^{32}\) When treating patients with AF, evidence-based guidelines emphasize the need for rate control, prevention of thromboembolism, and symptom-driven correction of the arrhythmia.\(^{33}\) Without an AF diagnosis, however, anticoagulation strategies are not indicated despite the presence of multiple stroke risk factors.

Early diagnosis of paroxysmal AF is difficult because it is based on obtaining an electrocardiogram that captures the arrhythmia that can be unpredictable in presentation, duration, and onset. As such, a number of continuous long-term monitors are frequently used. These monitors increase diagnostic yield of subclinical and clinical AF.\(^{5,34}\) However, these devices have temporal limitations and often need to be used in patients at highest risk of AF, such as those who experienced a transient ischemic attack or stroke. Implantable devices provide the best long-term solution for cardiac monitoring, but generally their use is in patients who have a requisite cardiovascular need outside monitoring. ASSERT included 2580 patients with a recently implanted pacemaker or implantable cardioverter defibrillator. Devices were programmed to diagnose a significant atrial arrhythmia if they lasted more than 6 minutes and the atrial rate was greater than 190/min. Atrial arrhythmias were diagnosed in 261 patients. Detection of atrial arrhythmias was significantly associated with stroke (relative risk, 2.49; \(P = .007\)). In patients with a CHADS\(_2\) (congestive heart failure, hypertension, age of 75 years, diabetes mellitus, and stroke) score of 2 or higher, device detection of atrial arrhythmias increased the absolute risk of stroke to 2.1% per year.\(^{31}\) The ASSERT data reveal the value of early arrhythmia detection in general and in particular

### TABLE 4. Performance of the AF Risk Score

<table>
<thead>
<tr>
<th>AF risk score</th>
<th>No. of true-positive results</th>
<th>No. of false-positive results</th>
<th>No. of false-negative results</th>
<th>No. of true-negative results</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>Positive predictive value (%)</th>
<th>Negative predictive value (%)</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3116</td>
<td>49,959</td>
<td>315</td>
<td>44,519</td>
<td>90.8</td>
<td>47.1</td>
<td>5.9</td>
<td>99.3</td>
<td>48.7</td>
</tr>
<tr>
<td>2</td>
<td>2429</td>
<td>16,659</td>
<td>1002</td>
<td>77,819</td>
<td>70.8</td>
<td>82.4</td>
<td>12.7</td>
<td>98.7</td>
<td>82.0</td>
</tr>
<tr>
<td>3</td>
<td>1662</td>
<td>8093</td>
<td>1769</td>
<td>86,385</td>
<td>48.4</td>
<td>91.4</td>
<td>17.0</td>
<td>98.0</td>
<td>89.9</td>
</tr>
<tr>
<td>4</td>
<td>1022</td>
<td>3890</td>
<td>2409</td>
<td>90,588</td>
<td>29.8</td>
<td>95.9</td>
<td>20.8</td>
<td>97.4</td>
<td>93.6</td>
</tr>
<tr>
<td>≥5</td>
<td>658</td>
<td>2311</td>
<td>2773</td>
<td>92,167</td>
<td>19.0</td>
<td>97.6</td>
<td>22.2</td>
<td>97.1</td>
<td>94.8</td>
</tr>
</tbody>
</table>

\(^{a}\)AF = atrial fibrillation.

\(^{b}\)Defined as (true-positive results + true-negative results)/total population.
in those who have cardiovascular risk factors of stroke. Unfortunately, most patients with AF do not have a pacemaker, so screening tools that can be used in a large general population are needed.

In addition to stroke prevention, data suggest other potential benefits with early AF diagnosis and management. For example, earlier treatment with drug therapy or catheter ablation improves AF-related outcomes. Dronedarone use is associated with lower rates of death, heart failure hospitalization, and arrhythmia burden in patients with early-onset paroxysmal AF and no significant structural heart disease. Unfortunately, this same drug will increase these adverse events when the AF progresses to chronic or heart disease worsens. Regarding catheter ablation for AF, we found that procedural success decreases if the time between catheter ablation for AF and no signi
cant structural heart disease. Unfortunately, this same drug will increase these adverse events when the AF progresses to chronic or heart disease worsens. Regarding catheter ablation for AF, we found that procedural success decreases if the time between first electrocardiographic diagnosis and catheter ablation is greater than 6 months. These data indicate that earlier detection and treatment of AF can improve these patients’ outcomes. For these reasons, there is significant need to evaluate AF risk prediction instruments and improve AF detection and monitoring.

Previous AF risk score tools have been created based on the evaluation of large population study data sets. However, their scoring tools are more complex than the one we have presented and do not incorporate readily available clinical markers alone. We anticipate that the simpler the AF risk scoring tool, the more likely it will be adopted into early screening to identify patients for further AF monitoring, which in turn will allow for an earlier diagnosis for those patients with AF.

Often, a meta-analysis is performed via a formal search of databases for relevant literature on a predefined protocol and selection criteria. Any such protocol and selection criteria may be subject to bias, and so we relied on the review to select the studies for inclusion in our analysis.

Patient-level data were not available for analysis from the source publications, and our approach modeled the reported aggregate numbers of patients with AF and each risk factor. As such, it was not possible to produce multivariable ORs that would adjust for the presence of confounding in the estimation of the odds of AF for a particular risk factor. Nonetheless, the validation exercise reveals that the AF risk score can be used to classify patients into increasing levels of risk. We speculate this success may be partially due to the downward rounding of the univariate ORs that we used to formulate the AF risk score and that each risk factor may in fact capture different aspects of the disease process.

The source articles used to develop the AF risk score used data from a variety of sources, some on the basis of incidence and some on prevalence. Although this is a potential limitation and can create the question of interpretability, validation on the basis of actual patient records revealed that the risk factor score can accurately stratify patients on the basis of incidence.

The validation cohort’s validity is limited by the fact that patients with risk factors may receive additional evaluation for the diagnosis of AF. Furthermore, the validation study data were derived from a large population-based health care network database. This study relies on the medical records and the ability of physicians to diagnose and document the disease states. The treatments of these patients differed, and as such individualized therapy or lack of therapy may have influenced disease risk. In addition, the study relies on the system-wide electrocardiogram database. Referral for electrocardiograms is typically based on the emergence of symptoms, but in patients with higher risk of disease, these tests may be used more often. Consequently, there is an inherent bias in disease diagnosis and diagnostic test use in patients with higher risks for the disease. To minimize this bias in this type of study design, we used a large population of randomly selected outpatients within the health network. Despite this bias, these data reflect clinical practice in the community and as such reveal the robustness of this prediction tool in identifying patients at risk of AF.

The validation cohort’s validity is limited by the fact that only diagnosed AF is captured in the patient database. A prospective study with excellent monitoring of asymptomatic, AF-free patients would be required to reveal true utility of the risk model for the detection of AF that otherwise would not have been diagnosed. Further investigation is needed to quantify the potential benefit of such a prospective study.

Another related limitation of our study is the low annual incidence of new AF each year. Given how devastating the consequences of untreated AF can be, we believe that
screening for AF in high-risk populations is warranted. Although we cannot say from these data that long-term cardiac monitoring using an implantable cardiac monitor should be performed in all patients with a score greater than 2, this should be considered given the low risk of modern implantable cardiac monitors. At a minimum, randomized trials of this strategy should be considered.

CONCLUSION

A clinical AF risk score made up of commonly collected clinical variables that are prevalent in the community can independently predict incident AF in patients with no history of the arrhythmia. This score may be useful for selecting patients for long-term monitoring for AF detection.

Abbreviations and Acronyms: AF = atrial fibrillation; ASSERT = Asymptomatic Atrial Fibrillation and Stroke Evaluation in Pacemaker Patients and the Atrial Fibrillation Reduction Atrial pacing Trial; ICD-9 = International Classification of Diseases, Ninth Revision; OR = odds ratio

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Potential Competing Interests: Mr Brunner and Dr Mahapatra are full time employees of St Jude Medical. Dr Bunch has served as a consultant for Biosense Webster, St Jude Medical, and Boston Scientific; Biosense Webster, and St Jude Medical. Mr Mullin is employed by NAMSA, a company that provides consulting services to St Jude Medical. Mr Elliot was an employee of Gilead Pharmaceuticals, Boston Scientific; Biosense Webster, and St Jude Medical. Mr Elliot was an employee of NAMSA, a company that provides consulting services to St Jude Medical at the time of this research. Dr May, Mr Mullin, and Dr Anderson have no competing interests to disclose.

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REFERENCES


