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Assessment of the Framingham risk factors among ED patients with newly diagnosed atrial fibrillation

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Abstract

Study Objective—Atrial fibrillation (AF) is often first diagnosed in the emergency department (ED) and accounts for nearly 1% of all ED visits. Our objective was to assess the Framingham Heart Study risk score for AF development in ED patients with newly diagnosed AF.

Methods—We systematically reviewed the electronic medical records of ED patients with newly diagnosed AF between August 2005 and July 2008. We measured the frequency of the Framingham Heart Study predictors and calculated each patient's risk score.

Results—During the 3-year study period, 914 patients had 1228 ED visits. New AF was diagnosed in 296 (32%) patients. Among these patients, 107 (36%) were female, 127 (43%) had prior ED visits since 2003, 189 (64%) were taking hypertension medications and 170 (57.4%) had previous electrocardiograms with measurable PR intervals. The median PR interval was 166 ms (151 to 180) and 60% of available PR intervals were ≥ 160 ms. The median (Interquartile range) age, body mass index, and systolic blood pressure were 66 years (53 to 77), 27 (23 to 31), and 134 mm Hg (118 to 151), respectively. Median risk score was 7 (3 to 9) indicating high predicted risk. Heart failure and cardiac murmurs were previously diagnosed in 45 (15%) and 32 (11%) of these patients, respectively.

Conclusions—The Framingham risk factors for AF are commonly encountered among ED patients with newly diagnosed AF. The ED might provide an opportunity to identify patients at high risk for AF and refer them for primary prevention interventions.

Keywords

Atrial fibrillation; risk factors; forecasting; primary prevention

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Introduction

Background

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia in clinical practice affecting over 2.2 million individuals in the United States. [1,2] The prevalence of AF is expected to double by 2020. [1] AF is associated with a 4–5 fold increase in the risk of stroke, 3-fold increase in the risk of heart failure and 1.5–1.9 increased risk of death. [3–7] Previous studies had shown that advanced age, hypertension, diabetes and cardiovascular disease are associated with an increased risk of developing AF. [4,8,9]

Because of the increasing incidence of AF, the National Heart Lung and Blood Institute (NHLBI) convened an expert panel in April 2008 and identified knowledge gaps in the epidemiology of AF. The panel recommended the development and validation of "incident AF risk prediction models across cohorts". [10] A clinical prediction model for identifying risk of developing AF was recently developed based on patients selected from the Framingham Heart Study Cohort. [11] The risk score was developed from a cohort of 4764 patients with a 10% incidence of AF and included the following variables: age, sex, body-mass index (BMI), systolic blood pressure (SBP), treatment for hypertension, PR interval, age of clinically significant cardiac murmur diagnosis, and age of heart failure diagnosis. [11] The complete list of variables and risk scores is presented in Table Appendix 1.

AF is often first diagnosed when patients present to the Emergency Department (ED) for AF-related complaints. [12,13] AF-related complaints include signs (tachycardia, dyspnea) or symptoms (palpitations, chest pain, shortness of breath, weakness, lightheadedness, pre-syncope, or syncope) consistent with symptomatic AF. [12,13] Pulse measurements and electrocardiograms, both of which are performed regularly in the ED, also diagnose new AF in otherwise asymptomatic individuals. [14,15] This study's objective was to describe the frequencies of these risk factors and calculate the corresponding risk score in a cohort of ED patients with newly diagnosed AF.

Materials and Methods

Study Design

This was a secondary analysis of a retrospective, observational cohort analysis based on the electronic medical records (EMR) of patients evaluated in an urban academic medical center's adult emergency department. The study was reviewed and approved by our medical center's institutional review board.

Setting—The study took place at an urban, university-affiliated, adult ED with an annual volume of 54,000 patients. All adult patients with a primary or supporting ICD-9 diagnosis of AF treated between August 2005 and July 2008 were included. Inclusion criteria required documented evidence of AF or atrial flutter on an electrocardiographic (ECG) or rhythm strip in the subject's EMR. We included only the first ED visit when a patient had multiple ED visits during the study period. We excluded patients whose ED visits were for complaints not related to their AF diagnosis (e.g., isolated orthopedic injuries, psychiatric complaints). We classified patients by their AF type (new diagnosis, paroxysmal/persistent, or permanent) and included only patients with newly diagnosed AF in this study.

Detailed Methodology—We systematically reviewed the electronic medical record for corresponding data. Two investigators extensively examined the entire medical records adhering to strict chart review methodology guidelines. [16] The study's principal investigator, an ED faculty physician, and a second year ED resident physician were the 2

data abstractors. Both abstractors trained on a set of 10 records. We recorded information on patient past and current medical history, home medications, physical exam findings, and diagnostic test results. Data were entered directly into a statistical database (SPSS, Version 17.0, Chicago, IL). We documented the presence of each of the Framingham risk score's variables for each patient. Given the retrospective cohort study design and inherent limitations, we had to revise some of the variables definitions using the data available at the time of AF diagnosis for the majority of the variables. In the original study, patient's age referred to age at time of enrollment in cohort. We had to substitute age at time of AF diagnosis. BMI, SBP and current treatment for hypertension were also based on information available at time of AF diagnosis in the ED. The documentation of the PR interval is not possible when a patient is in AF. Therefore, we substituted either the PR interval from the same visit if the patient returned to sinus rhythm or a PR interval from a recent prior ECG as long as the patient had not been started on atrioventricular node (AV) blocking agents in the interim. AV nodal blocking medications (e.g. beta blockers and calcium channel blockers) can affect cardiac conduction times and alter PR interval [17] resulting in a potentially unreliable estimate of the patient's true PR interval. We searched the EMRs for age at which significant cardiac murmur developed and age of heart failure, when applicable.

Framingham Heart Study Risk Score Interpretation—The Framingham risk score includes the following variables: age, sex, body-mass index (BMI), systolic blood pressure (SBP), treatment for hypertension, PR interval, age of clinically significant cardiac murmur diagnosis, and age of heart failure diagnosis. [11] The scoring system assigns points for each of the variables (0 or 1 for categorical variables and -3 to 10 for the continuous variables). The total score corresponds to an absolute risk of developing AF in the following 10 years. Patients with scores of ≤ 0 , 1, 3, 5, 7, and ≥ 10 had predicted risks of $\leq 1\%$, 2%, 3%, 6%, 12% and $>30\%$, respectively. [11]

Primary Data Analysis

All analyses were done using the statistical programming language R, version 2.8.1. [18–20] Descriptive statistics of baseline variables overall and across sex are presented as median (Interquartile range (IQR)) or % (N) as appropriate. Tests of association (Wilcoxon Rank Sum test or Pearson chi-square test as appropriate) were stratified by sex. Missing values were assumed to have occurred at random given the other covariates. We decided a priori to use multiple imputation methods, when appropriate, for incomplete variable data. Multiple imputation was used to derive predictions for missing values of BMI and PR interval. [19,21,22] In contrast, because of the large degree of missing values for both age at which significant cardiac murmur developed and the age of heart failure ($>85\%$ for both), all missing values were assumed to imply that neither cardiac murmur nor heart failure had been present. We computed the Framingham Heart Study risk score as outlined in Schnabel et al using the substitute measures described in the previous section and the imputed data. [11] A sensitivity analysis computing risk scores from the original data was done.

Results

The original cohort included 914 patients who accounted for 1228 ED visits over the 3-year study period. We included only the patient's first ED visit in the analysis. An additional 80 patients were excluded for non-AF related complaints such as minor orthopedic injuries and isolated psychiatric complaints. Of the remaining 834, AF was newly diagnosed in 296 patients (35.4%) who comprised our cohort. The baseline characteristics and the distribution of the Framingham AF risk factors are presented in Table 1. Of these 296 patients, 127 (43%) had at least one prior ED visit (range of prior ED visits: 0 to 17) since August 2003 reported in our EMR.

Among the patients with new AF diagnosed in the ED, 36% were female and the median age (IQR) was 66 years (53 to 77). Our cohort was predominantly Caucasian (81%) with 16% African-American and 2% Asian and Latino. Nearly 30% of these patients had BMI ≥ 30 and 64% were taking antihypertensive medications at the time of AF diagnosis in the ED. The median risk score was 7 (IQR 3 to 9) with values for this cohort of patients with newly diagnosed AF ranging from -3 to 18. Results were similar using the original data. The distribution of adjusted risk scores is presented in Figure 1.

The study cohort included 30 patients (10%) who were less than 45 years of age, the lower age limit enrolled in the Framingham risk score derivation study. [11] The prevalence of BMI ≥ 30 , treatment for hypertension and heart failure were 37%, 31% and 10%, respectively. Table 2 presents the frequency of the AF risk factors in these patients.

Limitations

This study was a retrospective chart review and therefore is subject to the limitations that affect all retrospective cohort analyses. Furthermore, unlike the risk score derivation study that prospectively followed patients until AF was diagnosed, our cohort consisted only of patients with a known new diagnosis of AF. This introduces a significant selection bias; however, our intent was to measure the frequency of the Framingham risk factors in a novel ED population and not replicate the Framingham risk analysis. Measuring the frequency of these risk factors in an ED cohort of matched controls without atrial fibrillation would increase the impact of our results but that data is not available. The retrospective analysis also required that we adjust the definitions for the risk factors including substituting age at time of diagnosis for age at time of enrollment in the Framingham cohort. Altering the components of the risk score very likely might have impacted the calculated risk scores. Additional independent studies are required to validate the Framingham risk score.

Discussion

Our study provides additional data supporting the AF risk scoring system developed by Schnabel et al. in a cohort of ED patients with newly diagnosed AF. [11] During the 3-year study period, AF was newly diagnosed in more than a third of all ED patients treated for an AF-related complaint. More than 50% of these patients had an adjusted Framingham risk score of ≥ 7 and less than 10% of the cohort had no risk factors (adjusted risk score < 1). Based on the median risk score of 7, more than half of these ED patients were at high risk (predicted absolute risks of 12% to $>30\%$) for developing AF within the next 10 years.

Visits to the ED for AF-related complaints increased by 88% between 1993 and 2003 and now account for nearly 1% of all ED encounters in the United States. [13,23–25] The ageing population and increasing AF prevalence and incidence will likely continue this trend. [24] AF is often first diagnosed in the ED setting and many patients ultimately diagnosed with AF are frequently seen in the ED for AF-related complaints. [12,13] Our review of 296 patients diagnosed with new AF in the ED over a 3 year-period found nearly half of these patients were seen in the ED prior to the AF diagnosis. The ED presents an opportunity to potentially identify patients at high risk for developing AF and direct these individuals to appropriate interventions that might delay or prevent the onset of the disease. The Framingham Heart Study risk score might be a facile instrument for predicting AF in this population. Treatment for hypertension and a PR interval >160 ms were the most common risk factors in our population. Cheng et al reported that individuals with first-degree AV block had a 2-fold adjusted risk of developing AF. [17] Both of these risk factors for AF are easily ascertained in the ED. Potentially, ED physicians might identify these high risk individuals and encourage them to follow-up with their primary care provider to begin an

aggressive health promotion program. Educating these patients about their risk for AF and the associated 4–5 fold increase risk of stroke, 3-fold increase in developing heart failure and potential need to be on lifelong blood thinners might motivate patients to initiate preventive therapies. [3–7] Recent literature has promoted the benefits of treatments including initiating renin-angiotensin-aldosterone system inhibitors, statin drugs, beta-blockers, and/or dietary omega-3 fatty acids supplements that might delay or prevent their incident AF. [26–35] A meta-analysis reviewed 11 trials and over 56,000 patients and found that angiotensin converting enzyme inhibitors (ACEI) and angiotensin receptor blockers reduced the relative risk of AF by 28% (95% CI 15 to 40%). [26] Valsartan-based treatment performed better than amlodipine-based treatment at reducing the incidence of AF, particularly sustained AF, in patients with hypertension. [30] ACEI treatment was also shown to be effective in preventing relapses of lone AF. [31] A study of losartan's impact on atrial conduction using EKG P wave duration found that losartan inhibits atrial remodeling and improves atrial conduction disturbance and suppresses AF recurrence. [32] Initiating statin therapy decreased the incidence of AF in patients with heart failure [33] and when started in patients within 1 month following hospitalization for coronary artery disease. [34] A meta-analysis of 7 studies including nearly 12,000 patients concluded that beta-blockers reduced the incidence of AF with a relative reduction of 27%. [35] Other trials have not found a significant reduction in the incidence of AF with ACEI and statins. [36,37] Dietary modifications including reduction in alcohol consumption and intake of fish-derived n-3 polyunsaturated fatty acids might prevent AF episodes following cardiovascular events. [38] The impact of these various treatment options in preventing or delaying the onset of AF continues to be intensely investigated. [10,39]

In conclusion, this study reports that Framingham risk factors are commonly found among a cohort of ED patients with newly diagnosed AF. The NHLBI recommended that research be focused on the primary prevention of AF through improved understanding of the epidemiology of AF and improved detection of AF. [10] The ED might provide an opportunity to identify patients at high risk for AF and direct these individuals to aggressive primary prevention measures to delay or prevent the onset of the arrhythmia.

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References

1. Go AS, Hylek EM, Phillips KA, et al. Prevalence of diagnosed atrial fibrillation in adults: national implications for rhythm management and stroke prevention: the AnTicoagulation and Risk Factors in Atrial Fibrillation (ATRIA) Study. *JAMA*. 2001; 285(18):2370–2375. [PubMed: 11343485]
2. Miyasaka Y, Barnes ME, Gersh BJ, et al. Secular trends in incidence of atrial fibrillation in Olmsted County, Minnesota, 1980 to 2000, and implications on the projections for future prevalence. *Circulation*. 2006; 114(2):119–125. [PubMed: 16818816]
3. Benjamin EJ, Wolf PA, D'Agostino RB, Silbershatz H, Kannel WB, Levy D. Impact of atrial fibrillation on the risk of death: the Framingham Heart Study. *Circulation*. 1998; 98(10):946–952. [PubMed: 9737513]
4. Krahn AD, Manfreda J, Tate RB, Mathewson FA, Cuddy TE. The natural history of atrial fibrillation: incidence, risk factors, and prognosis in the Manitoba Follow-Up Study. *Am J Med*. 1995; 98(5):476–484. [PubMed: 7733127]

5. Stewart S, Hart CL, Hole DJ, McMurray JJ. A population-based study of the long-term risks associated with atrial fibrillation: 20-year follow-up of the Renfrew/Paisley study. *Am J Med.* 2002; 113(5):359–364. [PubMed: 12401529]
6. Wolf PA, Abbott RD, Kannel WB. Atrial fibrillation as an independent risk factor for stroke: the Framingham Study. *Stroke.* 1991; 22(8):983–988. [PubMed: 1866765]
7. Wolf PA, Dawber TR, Thomas HE Jr, Kannel WB. Epidemiologic assessment of chronic atrial fibrillation and risk of stroke: the Framingham study. *Neurology.* 1978; 28(10):973–977. [PubMed: 570666]
8. Benjamin EJ, Levy D, Vaziri SM, D'Agostino RB, Belanger AJ, Wolf PA. Independent risk factors for atrial fibrillation in a population-based cohort. The Framingham Heart Study. *JAMA.* 1994; 271(11):840–844. [PubMed: 8114238]
9. Kannel WB, Wolf PA, Benjamin EJ, Levy D. Prevalence, incidence, prognosis, and predisposing conditions for atrial fibrillation: population-based estimates. *Am J Cardiol.* 1998; 82(8A):2N–9N.
10. Benjamin EJ, Chen PS, Bild DE, et al. Prevention of atrial fibrillation: report from a national heart, lung, and blood institute workshop. *Circulation.* 2009; 119(4):606–618. [PubMed: 19188521]
11. Schnabel RB, Sullivan LM, Levy D, et al. Development of a risk score for atrial fibrillation (Framingham Heart Study): a community-based cohort study. *Lancet.* 2009; 373:739–745. [PubMed: 19249635]
12. Stiell IG, Clement CM, Symington C, Perry JJ, Vaillancourt C, Wells GA. Emergency department use of intravenous procainamide for patients with acute atrial fibrillation or flutter. *Acad Emerg Med.* 2007; 14(12):1158–1164. [PubMed: 18045891]
13. Zimetbaum P, Reynolds MR, Ho KK, et al. Impact of a practice guideline for patients with atrial fibrillation on medical resource utilization and costs. *Am J Cardiol.* 2003; 92(6):677–681. [PubMed: 12972105]
14. Fitzmaurice DA, Hobbs FD, Jowett S, et al. Screening versus routine practice in detection of atrial fibrillation in patients aged 65 or over: cluster randomised controlled trial. *BMJ.* 2007; 335:383. [PubMed: 17673732]
15. Psaty BM, Manolio TA, Kuller LH, et al. Incidence of and risk factors for atrial fibrillation in older adults. *Circulation.* 1997; 96(7):2455–2461. [PubMed: 9337224]
16. Gilbert EH, Lowenstein SR, Koziol-McLain J, Barta DC, Steiner J. Chart reviews in emergency medicine research: Where are the methods? *Ann Emerg Med.* 1996; 27(3):305–308. [PubMed: 8599488]
17. Cheng S, Keyes MJ, Larson MG, et al. Long-term outcomes in individuals with prolonged PR interval or first-degree atrioventricular block. *JAMA.* 2009; 301:2571–2577. [PubMed: 19549974]
18. Harrell, FE. Design: Design Package. R package version 2.2-0. 2009. <http://CRAN.R-project.org/package=Design>
19. Harrell, FE. Hmisc: Harrell Miscellaneous. R package version 3.6-0. 2009. and with contributions from many other users. <http://CRAN.R-project.org/package=Hmisc>
20. R Development Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, editor. Vienna, Austria: 2009. ISBN 3-900051-07-0, URL <http://www.R-project.org>
21. Donders AR, van der Heijden GJ, Stijnen T, Moons KG. Review: a gentle introduction to imputation of missing values. *J Clin Epidemiol.* 2006; 59(10):1087–1091. [PubMed: 16980149]
22. van der Heijden GJ, Donders AR, Stijnen T, Moons KG. Imputation of missing values is superior to complete case analysis and the missing-indicator method in multivariable diagnostic research: a clinical example. *J Clin Epidemiol.* 2006; 59(10):1102–1109. [PubMed: 16980151]
23. Decker WW, Smars PA, Vaidyanathan L, et al. A prospective, randomized trial of an emergency department observation unit for acute onset atrial fibrillation. *Ann Emerg Med.* 2008; 52(4):322–328. [PubMed: 18339449]
24. McDonald AJ, Pelletier AJ, Ellinor PT, Camargo CA Jr. Increasing US emergency department visit rates and subsequent hospital admissions for atrial fibrillation from 1993 to 2004. *Ann Emerg Med.* 2008; 51(1):58–65. [PubMed: 17466409]
25. del Arco C, Martin A, Laguna P, et al. Analysis of Current Management of atrial Fibrillation in the Acute Setting: GEFAUR-1 Study. *Ann Emerg Med.* 2005; 46:424–430. [PubMed: 16271674]

26. Healey JS, Baranchuk A, Crystal E, et al. Prevention of atrial fibrillation with angiotensin-converting enzyme inhibitors and angiotensin receptor blockers: a meta-analysis. *J Am Coll Cardiol.* 2005; 45(11):1832–1839. [PubMed: 15936615]
27. Fauchier L, Pierre B, de Labriolle A, Grimard C, Zannad N, Babuty D. Antiarrhythmic effect of statin therapy and atrial fibrillation a meta-analysis of randomized controlled trials. *J Am Coll Cardiol.* 2008; 51(8):828–835. [PubMed: 18294568]
28. Flather MD, Shibata MC, Coats AJ, et al. Randomized trial to determine the effect of nebivolol on mortality and cardiovascular hospital admission in elderly patients with heart failure (SENIORS). *Eur Heart J.* 2005; 26(3):215–225. [PubMed: 15642700]
29. London B, Albert C, Anderson ME, et al. Omega-3 fatty acids and cardiac arrhythmias: prior studies and recommendations for future research: a report from the National Heart, Lung, and Blood Institute and Office Of Dietary Supplements Omega-3 Fatty Acids and their Role in Cardiac Arrhythmogenesis Workshop. *Circulation.* 2007; 116(10):e320–e335. [PubMed: 17768297]
30. Schmieder RE, Kjeldsen SE, Julius S, McInnes GT, Zanchetti A, Hua TA. VALUE Trial Group. Reduced incidence of new-onset atrial fibrillation with angiotensin II receptor blockade: the VALUE trial. *J Hypertens.* 2008; 26(3):403–411. [PubMed: 18300848]
31. Belluzzi F, Sernesi L, Preti P, Salinaro F, Fonte ML, Perlini S. Prevention of recurrent lone atrial fibrillation by the angiotensin-II converting enzyme inhibitor ramipril in normotensive patients. *J Am Coll Cardiol.* 2009; 53(1):24–29. [PubMed: 19118720]
32. Nomura M, Kawano T, Nakayasu K, Nakaya Y. The effects of losartan on signal-averaged P wave in patients with atrial fibrillation. *Int J Cardiol.* 2008; 126(1):21–27. [PubMed: 17509704]
33. Maggioni AP, Fabbri G, Lucci D, Marchioli R, Franzosi MG, Latini R, Nicolosi GL, Porcu M, Cosmi F, Stefanelli S, Tognoni G, Tavazzi L. GISSI-HF Investigators. Effects of rosuvastatin on atrial fibrillation occurrence: ancillary results of the GISSI-HF trial. *Eur Heart J.* 2009; 30(19):2327–2336. [PubMed: 19717850]
34. Kulik A, Singh JP, Levin R, Avorn J, Choudhry NK. Association between statin use and the incidence of atrial fibrillation following hospitalization for coronary artery disease. *Am J Cardiol.* 2010; 105(12):1655–1660. [PubMed: 20538110]
35. Nasr IA, Bouzamondo A, Hulot JS, Dubourg O, Le Heuzey JY, Lechat P. Prevention of atrial fibrillation onset by beta-blocker treatment in heart failure: a meta-analysis. *Eur Heart J.* 2007; 28(4):457–462. [PubMed: 17289748]
36. Salehian O, Healey J, Stambler B, Alnemer K, Almerri K, Grover J, Bata I, Mann J, Matthew J, Pogue J, Yusuf S, Dagenais G, Lonn E. HOPE Investigators. Impact of ramipril on the incidence of atrial fibrillation: results of the Heart Outcomes Prevention Evaluation study. *Am Heart J.* 2007; 154(3):448–453. [PubMed: 17719288]
37. Haywood LJ, Ford CE, Crow RS, Davis BR, Massie BM, Einhorn PT, Williard A. ALLHAT Collaborative Research Group. Atrial fibrillation at baseline and during follow-up in ALLHAT (Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial). *J Am Coll Cardiol.* 2009; 54(22):2023–2031. [PubMed: 19926008]
38. Gronroos NN, Alonso A. Diet and risk of atrial fibrillation – epidemiologic and clinical evidence. *Circ J.* 2010; 74(10):2029–2038. [PubMed: 20838006]
39. Savelieva I, Camm J. Is there any hope for angiotensin-converting enzyme inhibitors in atrial fibrillation? *Am Heart J.* 2007; 154(3):403–406. [PubMed: 17719281]

Figure 1.
 Box Plot Representation Of Calculated Framingham Heart Study Risk Scores For Patients With Newly Diagnosed AF.
 Box plot whiskers show the largest/smallest observation that falls within a distance of 1.5 times the box size from the nearest hinge.

Table 1

Baseline Characteristics Of Emergency Department Patients With Newly Diagnosed Atrial Fibrillation.

	N	Female N=107	Male N=189	Combined N=296
Ethnicity	295			
Caucasian		83 (78%)	157 (83%)	240 (81%)
African American		23 (22%)	25 (13%)	48 (16%)
Latino/Hispanic		0	3 (2%)	3 (1%)
Asian		0	1 (1%)	1 (0%)
Other		0	3 (2%)	3 (1%)
Age in years	296	73 (59–82)	63 (49–72)	66 (53–77)
Age by Framingham category:	296			
<= 49		11 (10%)	50 (26%)	61 (21%)
50–54		6 (6%)	16 (8%)	22 (7%)
55–59		12 (11%)	16 (8%)	28 (9%)
60–64		10 (9%)	20 (11%)	30 (10%)
65–69		12 (11%)	31 (16%)	43 (15%)
70–74		7 (7%)	17 (9%)	24 (8%)
75–79		15 (14%)	20 (11%)	35 (12%)
80–84		13 (12%)	9 (5%)	22 (7%)
>=85		21 (20%)	10 (5%)	31 (10%)
BMI	262	26 (22–30)	27 (24–31)	27 (23–31)
BMI by Framingham category: >= 30	262	25 (26%)	52 (31%)	77 (29%)
SBP (in mm Hg) (median and IQR)	296	134 (119–154)	133 (117–150)	134 (118–151)
SBP by Framingham category: >= 160	296	20 (19%)	31 (16%)	51 (17%)
DBP (in mm Hg) (median and IQR)	283	78 (67–91)	80 (68–90)	79 (68–91)
Pulse (bpm)	292	122 (99–142)	115 (95–141)	117 (97–142)
Insulin-dependent diabetes: Yes	296	5 (5%)	15 (8%)	20 (7%)
Non-insulin-dependent diabetes: Yes	296	20 (19%)	25 (13%)	45 (15%)
History of hypertension: Yes	296	68 (64%)	113 (60%)	181 (61%)
Current use of hypertension medications: Yes	296	72 (67%)	117 (62%)	189 (64%)
History of heart failure: Yes	296	18 (17%)	27 (14%)	45 (15%)
Age (in years) when heart failure noted	44	73 (61–82)	61 (48–70)	65 (54–74)
Age when heart failure noted (Framingham categories):	44			
<= 54		2 (12%)	10 (37%)	12 (27%)
55–64		3 (18%)	7 (26%)	10 (23%)
65–74		4 (24%)	7 (26%)	11 (25%)
>= 75		8 (47%)	3 (11%)	11 (25%)
Cardiac murmur: Yes	296	18 (17%)	14 (7%)	32 (11%)
Age (in years) when cardiac murmur noted	31	73 (61–82)	61 (48–70)	65 (54–74)

	N	Female N=107	Male N=189	Combined N=296
Age when cardiac murmur noted (Framingham categories):	31			
<= 54		2 (11%)	3 (23%)	5 (16%)
55–64		2 (11%)	3 (23%)	5 (16%)
65–74		5 (28%)	3 (23%)	8 (26%)
75–84		6 (33%)	3 (23%)	9 (29%)
>= 85		3 (17%)	1 (8%)	4 (13%)
PR interval on prior ECG (in msec)	170	166 (150–178)	167 (152–180)	166 (151–180)
PR interval (post diagnosis)	21	152 (146–162)	168 (148–186)	160 (144–172)
Days between diagnosis and ECG	72	1 (0–2.2)	1 (0–1.2)	1 (0–2.0)
PR interval (pre and post diagnosis)	191	164 (150–178)	167 (152–180)	165 (150–180)
PR interval by Framingham category:	191			
< 160 msec		31 (43%)	46 (39%)	77 (40%)
160–199 msec		34 (47%)	56 (47%)	90 (47%)
>= 200 msec		7 (10%)	17 (14%)	24 (13%)

Continuous variables are presented as Median and Interquartile range. Categorical variables are presented as N (number of non-missing values) followed by percentages.

Table 2

Frequencies Of Framingham Risk Factors For Subjects < 45 Years Of Age

	N
BMI by Framingham category	30
< 30	19 (63%)
>= 30	11 (37%)
SBP by Framingham category	36
< 160 mm Hg	28 (78%)
>= 160 mm Hg	8 (22%)
Current use of hypertension medications:	36
Yes	11 (31%)
No	25 (69%)
PR interval by Framingham category:	19
< 160 msec	12 (63%)
160–199 msec	7 (37%)
>= 200 msec	0 (0%)
History of heart failure: Yes	3 (8%)
Cardiac murmur: Yes	0 (0%)

Table Appendix 1
Framingham Criteria Risk scores for factors associated with 10-year risk of atrial fibrillation [11]

Age (years)		
45–49	–3 (women);	1 (men)
50–54	–2 (women);	2 (men)
55–59	0 (women);	3 (men)
60–64	1 (women);	4 (men)
65–69	3 (women);	5 (men)
70–74	4 (women);	6 (men)
75–79	6 (women);	7 (men)
80–84	7 (women);	7 (men)
≥85	8 (women);	8 (men)
Body-mass index (kg/m2)		
<30	0	
≥30	1	
Systolic blood pressure (mm Hg)		
<160	0	
≥160	1	
Treatment for hypertension		
No	0	
Yes	1	
PR interval (ms)		
<160	0	
160–199	1	
≥200	2	
Age at which significant cardiac murmur developed (years)		
45–54	5	
55–64	4	
65–74	2	
75–84	1	
≥85	0	
Age of heart failure (years)		

45–54	10
55–64	6
65–74	2
≥75–84	0