

# Atrial fibrillation: prevalence in a large database of primary care patients in Brazil

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## Aims

Although an increasing prevalence of atrial fibrillation (AF) has been reported worldwide, there are few studies from low- and middle-income countries. Our objective is to assess the prevalence of AF and the associated medical conditions in Brazilian primary care patients.

## Methods and results

This is an observational retrospective study. Patients  $\geq 5$  years of age from primary care centres of 658 municipalities in Minas Gerais, Brazil, who performed digital electrocardiograms (ECGs) by a public telehealth service in 2011 were assessed. Clinical data were self-reported, and ECGs were interpreted by a team of trained cardiologists using standardized criteria. To assess the relation between clinical characteristics and AF, odds ratios were estimated by logistic regression. A total of 262 685 primary care patients were included, mean (SD) age of 50.3 (19.3) years, 59.6% female. Hypertension was reported in 32.0%, family history of coronary heart disease in 15.0%, diabetes in 5.4%, hyperlipidaemia in 2.8%, Chagas disease in 2.9%, and 7.1% reported current smoking. The prevalence of AF was 1.8% overall: 2.4% in men (ranging from 0.001% from 5–19 years old to 14.6% in nonagenarians) and 1.3% in women (ranging from 0.001% from 5–19 years old to 8.7% in nonagenarians) ( $P < 0.001$ ). The prevalence of AF increased with advancing age. The comorbidities associated with AF were Chagas disease, previous myocardial infarction, hypertension, and chronic obstructive pulmonary disease. Vitamin K antagonist use was reported by 1.5% of patients.

## Conclusion

The prevalence and age distribution of AF were similar to studies in high-income countries. The proportion of patients who reported the use of anticoagulants was alarmingly low. Our findings point out the necessity to formulate effective treatment strategies for AF in Brazilian primary care settings.

## Keywords

Atrial fibrillation • Atrial flutter • Primary healthcare • Electrocardiogram • Telehealth • Telecardiology

## Introduction

Atrial fibrillation (AF) is a growing public health problem, with enormous human, economic, and social burdens. It is associated with a substantial risk of all-cause mortality, cardiovascular mortality and sudden cardiac death, stroke, systemic thromboembolism, heart failure, and acute coronary syndrome.<sup>1,2</sup> Strokes associated with AF are usually more severe and confer increased risk of morbidity, mortality, and poor functional outcomes.<sup>3</sup>

An increasing prevalence of AF has been reported in the USA and worldwide.<sup>4</sup> However, there are few studies on the prevalence of AF from low- and middle-income countries.<sup>5,6</sup> Because of the heavy burden it exerts on the healthcare system and society, reliable

prevalence figures are of utmost importance for clinicians and healthcare decision makers. Therefore, the objective of this study was to assess the prevalence AF and the associated medical conditions in Brazilian primary care patients.

## Methods

We conducted a retrospective observational study. We assessed all patients who had a 12-lead digital electrocardiogram (ECG) recorded and analysed by cardiologists from the Telehealth Network of Minas Gerais (TNMG), a public telehealth service, from 1 January 2011 to 31 December 2011. This period of time was chosen for this analysis because the database before 2011 was not available for

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### What's new?

- The prevalence of AF in Brazilian primary care patients was 1.8% overall: 2.4% in men (ranging from 0.001% from 5–19 years old to 14.6% in nonagenarians) and 1.3% in women (ranging from 0.001% from 5–19 years old to 8.7% in nonagenarians).
- The prevalence of AF increased with advancing age, but the prevalence in the younger patients was higher than the prevalence in this age group in developing countries.
- The comorbidities associated with AF were Chagas disease, previous myocardial infarction, hypertension, and chronic obstructive pulmonary disease.
- Vitamin K antagonist use was reported by 1.5% of patients.

analysis. During 2011, the service performed ECG analysis for primary care centres of 658 municipalities in Minas Gerais, Brazil.<sup>7</sup>

Minas Gerais is the Brazilian state with the largest number of cities (853) and the second highest population, distributed in an area equivalent to France. It can be considered representative of the country, as age distribution and percentage of urbanization are similar to the overall national pattern, as is the social inequality: the north and the northeast of Minas Gerais have Human Development Index (HDI) similar to the North and Northeast Brazil, and while the west and south of the state have HDI similar to the areas with the highest HDI of the country.<sup>8</sup> The HDI was published by the United Nations Development Program as a composite statistic of life expectancy index, education index, and income index used to rank countries or cities.<sup>8</sup>

Clinical data (age, sex, comorbidities, and medications) were self-reported, and collected using a standardized questionnaire. Comorbidities included in the questionnaire were hypertension, diabetes, obesity, hyperlipidaemia, chronic kidney disease, chronic obstructive pulmonary disease, and Chagas disease. Smoking, family history of coronary disease, previous myocardial infarction, and previous coronary revascularization were also included. The digital ECGs were recorded in the municipalities and sent through the Internet to the central analysis centre. The ECGs were interpreted by a team of trained cardiologists, using standardized criteria.<sup>9</sup>

For the purpose of this study, ECGs with technical problems, such as interference or lead placement errors, were excluded, as well as ECGs from children from birth to 4 years of age. If the patient had more than one ECG recorded during the study, only the first one was analysed. The prevalence of AF and atrial flutter was assessed. Atrial fibrillation was diagnosed if either AF or atrial flutter of any duration was observed on the 12-lead ECG, as in other epidemiological studies.<sup>4</sup> Any demographic data, including the 2010 HDI from the city where the patients lived,<sup>8</sup> were assessed.

IBM SPSS Statistics for Windows version 20.0 (IBM Corp., Released 2011, Armonk, NY, USA) was used for statistical analysis. Categorical data were reported as counts and percentages; continuous variables were reported as mean and SD or median (25th, 75th percentiles), as appropriate. To assess the relation between clinical characteristics and AF, unadjusted and adjusted odds ratios were estimated by logistic regression. A two-tailed *P*-value of 0.05 was

**Table 1** Prevalence of AF according to age distribution and sex

Age group (years)	n	Prevalence (%)	
		Males	Females
5–19	19 000	0.001	0.001
20–29	23 161	0.2	0.1
30–39	33 262	0.3	0.2
40–49	46 852	0.7	0.3
50–59	52 658	1.6	0.7
60–69	44 126	3.2	1.9
70–79	30 349	6.3	4.1
80–89	11 702	9.8	6.7
≥90	1575	14.6	8.7

considered statistically significant. The study was approved by the Research Ethics Committee of the Universidade Federal de Minas Gerais.

## Results

During the study period, 287 241 patients underwent ECG recording. Of those, 24 556 ECGs with technical problems, interference, or lead placement errors (8.5%), and 1634 ECGs from children from birth to 4 years of age were excluded (0.6%). Therefore, 262 685 primary care patients were included (mean age 50.3, SD 19.3 years, 5% were ≥80 years old, and 59.6% were female). Hypertension was reported in 32.0%, family history of coronary heart disease in 15.0%, diabetes in 5.4%, hyperlipidaemia in 2.8%, Chagas disease in 2.9%, and 7.1% reported current smoking. The mean HDI of the cities where the patients lived was 0.664, SD 0.057, ranging from 0.529 to 0.810, and the median population was 9671 inhabitants (interquartile range 5537–17 739), ranging from 815 to 1 967 913.

The overall prevalence of AF was 1.8% ( $n = 4638$ ); 2.4% in men and 1.3% in women ( $P < 0.001$ ). A total of 0.08% had atrial flutter ( $n = 228$ ). The prevalence of AF increased sharply with older mean age, particularly from the age of 70 years, reaching 8.4% in octogenarians and 11.0% in nonagenarians; the prevalence was higher in men (vs. women) in all age groups (Table 1). The most common comorbidities in patients with AF were hypertension (51.8%), Chagas disease (8.8%), and diabetes (7.3%). The comorbidities associated with AF after adjustment for age and sex were Chagas disease, previous myocardial infarction, hypertension, and chronic obstructive pulmonary disease (Table 2). In AF patients, Vitamin K antagonist (warfarin or phenprocoumon) use was reported by 1.5%, and aspirin by 3.1%.

## Discussion

Our study is unique in that it provides data on prevalence of AF in the primary care setting in Brazil, based on a large database. The prevalence of AF was 1.8% in the whole population, 8.4% among

**Table 2** Characteristics of the study sample by prevalence of AF

Variable	Patients with AF (n = 4637)	Patients without AF (n = 259 687)	OR (95% CI)	Adjusted OR (95% CI) <sup>a</sup>
Age, years	70.3 (13.5)	49.9 (19.2)	1.08 (1.07–1.08)	–
Men	2523 (54.4)	104 258 (40.1)	1.78 (1.68–1.89)	–
Current smokers	309 (6.7)	18 501 (7.1)	0.93 (0.83–1.05)	0.92 (0.82–1.04)
Hypertension	2403 (51.8)	82 301 (31.7)	2.32 (2.19–2.46)	1.32 (1.24–1.40)
Diabetes	340 (7.3)	13 967 (5.4)	1.39 (1.07–1.47)	0.99 (0.88–1.11)
Dyslipidaemia	162 (3.5)	7272 (2.8)	1.39 (1.25–1.56)	1.02 (0.86–1.19)
Chagas disease	406 (8.8)	7184 (2.8)	3.37 (3.04–3.74)	3.15 (2.83–3.51)
COPD	63 (1.4)	1771 (0.7)	2.00 (1.56–2.58)	1.39 (1.07–1.80)
Previous MI	94 (2.0)	1815 (0.7)	2.94 (2.38–3.63)	2.01 (1.28–1.49)

Data are presented as mean (SD) or number (%).

OR, odds ratio; CI, confidence interval; COPD, chronic obstructive pulmonary disease; MI, myocardial infarction.

<sup>a</sup>Adjusted for age and sex.

octogenarians and 11.0% among nonagenarians. The prevalence of AF was strongly associated with higher mean age, and it was higher in men compared with women in all age groups. Hypertension was the most commonly associated disease, and Chagas disease was the comorbidity with the strongest association with AF. Warfarin use was reported by only 1.5% of patients.

Our findings about the prevalence of AF are similar to data from high-income countries, although different from the recent findings of the Global Burden of AF, which reported higher prevalence rates in developed countries when compared with developing countries.<sup>4</sup> This finding may be attributable to better surveillance in developed countries. In this study, it was observed that the prevalence was actually similar, except for the octogenarian group, which had a lower prevalence of AF in the present study, and the young patients, who are expected to be without risk of AF. The higher reported prevalence of AF in octogenarians in high-income countries may be due to variation in racial demography, variation in ascertainment strategies, and/or comorbidities. Although the racial distribution was not assessed in the present study, it is known that Brazil, like all of Latin America, is one of the most ethnographically heterogeneous regions of the world.<sup>10</sup> In addition, there may be a possible survival bias such that a higher proportion of Brazilian patients with AF may have premature deaths due to cardiac disease and stroke related to under-treatment. Indeed, a previous Brazilian survey in elderly residents of the city of São Paulo ( $n = 1524$ ) showed a prevalence of AF of 6.4% in women and of 7.9% in men of 80 years old or more, similar to our findings.<sup>11</sup>

The non-negligible prevalence of AF in young patients may be explained by the fact that rheumatic heart disease is still prevalent in the country. A recent study by Miranda *et al.*<sup>12</sup> assessed the prevalence of rheumatic heart disease among 267 school students aged between 6 and 16 years. Of the 267 students, 1.87% had echocardiographic criteria of subclinical chronic rheumatic disease. As part of the students who needed to be submitted to a confirmatory Doppler echocardiography was lost to follow-up, it is possible that the prevalence may be even higher.<sup>12</sup> The number of heart valve surgeries in Brazil is still high, with 7/100 000 inhabitants in 2012,<sup>13</sup> most of them due to rheumatic valvular disease. In the

same year, angioplasty was performed in 33/100 000 and coronary revascularization in 12/100 000 inhabitants.<sup>13</sup> Rheumatic valvular disease is recognized a major risk factor for AF. Diker *et al.*,<sup>14</sup> in 1100 patients with rheumatic heart disease in Turkey, observed a prevalence of AF in 29% of patients with isolated mitral stenosis, 16% of those with isolated mitral regurgitation, 1% of those with isolated aortic valvular disease.

The higher prevalence in men has already been reported in several studies in both high and low- and middle-income countries.<sup>4</sup> There is a suggestion that men's higher mean height may partially account for the higher prevalence of AF in men.<sup>15</sup>

Hypertension has been reported as the most frequent disease associated with AF.<sup>4,5</sup> Analysis of global risk factors in the Global Burden Disease 2010 study showed that high blood pressure is the number 1 risk factor globally.<sup>4</sup> Hypertension is a risk factor for the development of AF,<sup>15</sup> and a risk factor for ischaemic stroke and other cardioembolic events in patients with AF.<sup>16</sup>

Chagas disease is endemic in Latin American countries, and its association with AF is of clinical and epidemiological interest. It has been shown that patients with AF who have Chagas disease have a higher risk of stroke and other cardioembolic events.<sup>17</sup> Additionally, AF has been demonstrated to be a risk factor for mortality in patients with Chagas disease.<sup>18</sup>

Current AF treatment focuses on thrombo-embolic risk assessment and risk-appropriate anticoagulation, rhythm control in some symptomatic individuals, and aggressive cardiovascular risk factor modification.<sup>1</sup> Although there is strong evidence that anticoagulant therapy reduces the risk of stroke, other thrombo-embolic events and death,<sup>19</sup> the low proportion of patients who reported using anticoagulants is alarming. Other studies in low- and middle-income countries also reported a low percentage of patients on anticoagulation,<sup>5</sup> but in our study the prevalence was even lower. Possible explanations for this underuse include the lack of anticoagulation clinics in the state, except for the capital; lack of experience of primary care physicians in managing patients with AF and assessing the risk of cardioembolic events; fear of haemorrhagic complications such as intracranial bleeding; and limitations of vitamin K inhibitors use, as interactions with alcohol and other drugs.

The new anticoagulant drugs, which have less interactions, are still more expensive than vitamin K inhibitors and thus for most municipalities, they are not provided by the Brazilian government as yet. Additionally, for some patients, the physicians might not know about the arrhythmia before performing the ECG. Our findings have implications for public health policy and healthcare resource allocation, highlighting the urgent need to formulate effective treatment strategies for AF in primary care in Brazil.

The study has some limitations. As AF is often asymptomatic and can be intermittent,<sup>20</sup> the prevalence of AF may be underestimated. On the other hand, although the present study used data from a large sample, it was not a random sample obtained from the community. It included patients who seek primary care. Therefore, it may overestimate the prevalence in the community. Comorbidities and medication data were self-reported, and thus might have been underreported. It was not possible to assess the prevalence of stroke or to estimate the CHADS<sub>2</sub>, CHADS<sub>2</sub>-VASc, and HAS-BLED scores. Additionally, the proportion of patients in whom AF was associated with valvular heart disease, a condition that is still prevalent in developing countries and carries a high risk of stroke, was not assessed.

## Conclusions

In conclusion, in this study of a large sample of primary care patients, the prevalence of AF increased sharply with higher mean age and was higher in men than in women. The prevalence and age distribution of AF were similar to those found in studies in high-income countries. The proportion of patients who reported the use of anticoagulants was alarmingly low. Our findings have implications for public health policy, and point out the necessity to formulate effective treatment strategies for AF in primary care in Brazil.

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