The prevalence of atrial fibrillation in Greenland: a register-based cross-sectional study based on disease classifications and prescriptions of oral anticoagulants

N Albertsen, S Riahi, M Pedersen, N Skovgaard and S Andersen

ABSTRACT

Previous studies of the prevalence of atrial fibrillation (AF) in Greenland are based on either single-point electrocardiograms (ECGs) or patients admitted with stroke. This study estimates the prevalence of AF based on disease classifications in the electronic medical record system (EMR) and prescriptions of oral anticoagulants (OACs). Patients given a diagnose classification code for AF or atrial flutter or prescribed the vitamin K antagonist Warfarin or the direct-acting oral anticoagulant Rivaroxaban were identified in the EMR. Descriptive data and selected laboratory values were extracted, and a minimum CHA2DS2-VASc score was calculated for the 790 patients identified in the EMR (66% men). A total prevalence of AF of 1.4% was found in the general population (1.8% among men and 1.0% among women), with a significantly lower prevalence among women younger than 70 years. There was a significant increase in AF-prevalence with advancing age (p<0.001) for both men and women. A minimum CHA2DS2-VASc was estimated and app. 10% of the patients may be undertreated with OACs. The prevalence of AF found in this study is higher than that found in previous studies in Greenland and comparable to the prevalence found in other Western countries, indicating that AF is common in Greenland.

Introduction

Cardiovascular disease (CVD) in the Greenlandic population has been described in more detail during the past decades. It has previously been believed that the traditional Greenlandic diet, including high levels of omega-3 unsaturated fatty acids, protected Inuit against CVD, but no association was found in a prospective cohort study from 2020 [1]. In addition, the prevalence of coronary heart disease (CHD) has been found to correspond to the prevalence in Western countries based on markers of CHD, such as self-reported angina pectoris and ischaemic electrocardiogram (ECG) findings [2]. However, cardiac arrhythmias among the Greenlandic population have not been described in much detail. One study from 2009 based on single-point ECGs from 1963 indicated a low prevalence of atrial fibrillation (AF) among the Greenlandic population [3]. In contrast, a newer study from 2013 based on event recordings among patients admitted with stroke found that 30% of the patients had AF, and most of them were undiagnosed at the time of admission [4]. The latter study additionally found that Greenlanders seemingly suffered their ischaemic stroke at a younger age than stroke patients in Denmark. AF is a significant risk factor for ischaemic strokes [5,6], increasing the relative risk of stroke to 4.5 among the oldest patients [6]. A study from Canada [7] suggests that incident AF is more common at a younger age among the Indigenous people and young Indigenous people from Australia had a higher prevalence when compared to non-Indigenous people [8]. The reason is unknown, but studies from other parts of the world indicate that there are some ethnic differences regarding the risk of incident AF [9] and prevalence of AF [10], and some of these differences may be due to genetics [11,12].

However, it is well-established that the prevalence of several major risk factors for AF are increasing in Greenland. Type 2 diabetes affects between 15–34% of the population older than 65 years [13], 11.4% of the population are treated with antihypertensives [14]...
and the population is getting older. The expected lifetime has increased from 63 and 69 years to 69 and 73 years between 2000 and 2020 for men and women, respectively [15].

This study aims to estimate the prevalence of AF based on disease classification codes and prescribed oral anticoagulants (OACs) among the general population in Greenland.

Methods

Study design

The study was a retrospective cross-sectional based on data extracted from the electronic medical record system (EMR), Cambio COSMIC (Cambio, Sweden). COSMIC is used in all care settings of Greenland except one district in East Greenland and includes 96% of the population.

Data were anonymised and extracted from the EMR to Microsoft Excel® by a statistician (NS) from the Greenlandic Health Care System.

Setting and population

Greenland is a self-governing part of the kingdom of Denmark and home to 56,000 people. One-third of the population lives in the capital Nuuk, while the rest live in towns and settlements along the west, east and south coast.

Larger towns in Greenland have primary health care clinics with facilities allowing minor surgery and treatment for medical diseases such as infections, and settlements and small towns usually have a health care station with trained personnel. The only hospital in Greenland is located in Nuuk.

In Greenland, diseases are classified in the EMR by either the International Classification of Primary Care (ICPC) or the International Classification of Diseases, 10th revision (ICD –10). Patients are not always given disease classifications in the primary care settings in Greenland but consistently when discharged from hospitals in either Greenland or Denmark. Cardiovascular classifications in the EMR have been validated and agreed between 92% and 99% with patient records in Greenland [16].

Data extraction by disease classification

Data were extracted on patients classified with ICPC as having K78 (AF or atrial flutter (AFL)) or with ICD-10 as having D148 (AF or AFL), D1480 (paroxysmal AF), D1481 (persistent AF), D1482 (chronic AF), D1483 (typical AFL), D1484 (atypical AFL) or D1489 (unspecified AF or AFL).

CHA$_2$DS$_2$-VASc -score and anticoagulant treatment

The CHA$_2$DS$_2$-VASc score is an ischaemic stroke risk factor assessment tool intended for patients with AF. It includes common risk factors for stroke: congestive heart failure, hypertension, age, diabetes, stroke, vascular disease and gender [17]. It is generally accepted that a score of zero among males and one among females (female sex being an age-dependent risk factor) equals a low risk of ischaemic strokes and mortality, and these patients may not need anticoagulant treatment. However, treatment should be considered when definitive risk factors are present (previous stroke, embolism or transient ischaemic attack and age ≤ 75 years) or in male patients with a score of one and females with a score of two. Treatment with an OAC is recommended at higher scores [17].

The CHA$_2$DS$_2$-VASc score stated in the results is not the exact score but the minimum score for the study population, as data on vascular disease and congestive heart failure were not available for extraction.

Oral anticoagulant treatment includes the vitamin K antagonist (VKA) Warfarin and direct-acting oral anticoagulant (DOAC) Rivaroxaban, both of which reduce the risk of stroke and mortality in patients with AF [18,19]. Patients prescribed either Warfarin or Rivaroxaban were included in our study to minimise the loss of patients due to lack of disease classification, as Warfarin and Rivaroxaban are the only two oral anticoagulants available in Greenland. All active prescriptions in Greenland are registered in the EMR, and patients prescribed either drug were identified by searching the EMR using the drugs’ Anatomical Therapeutic Chemical (ATC) codes B01AA03 and B01AF01.

Risk factors and comorbidities

To assess well-known risk factors for AF and the prevalence of other diseases that may be caused by AF or treated with an oral anticoagulant, the most recent information on age, gender, smoking status, and blood pressure (BP) measurements were extracted from the EMR. ICD-10 classifications supplemented These data were supplemented by ICD-10 classification for pulmonary embolism (PE) (I260, I269, I269A), stroke (I631-I639, I649), transient ischaemic attack (TIA) (G459), deep venous thrombosis (DVT) (I800-1809) and presence of a prosthetic heart valve (Z952, Z954) and ICPC- and ICD-10 classifications for diabetes (T89, T90 and E100- E109, E110-E119). In addition, laboratory results for thyroid-stimulating hormone (TSH), cholesterol and glycated haemoglobin (HbA1c) were included. ATC-codes
Table 1. The estimated prevalence of AF/AFl in the Greenlandic population according to age and gender. The p-value relates to the test for differences between men and women.

|                | Men          | Women        | Total        | p-value |
|----------------|--------------|--------------|--------------|---------|
| All participants, % (95% CI) | 1.8 (1.6;1.9) | 1.0 (0.9;1.11) | 1.4 (1.3;1.5) | <0.001 |
| Age <60 years, % (95% CI) | 0.6 (0.5;0.7) | 0.3 (0.2;0.4) | 0.4 (0.4;0.5) | <0.001 |
| Age 60–69 years% (95% CI), | 5.9 (5.1;6.7) | 2.6 (2.0;3.3) | 4.5 (3.9;5.1) | <0.001 |
| Age 70+, % (95% CI) | 11.9 (10.3;13.6) | 10.1 (8.6;11.8) | 11.0 (9.9;12.2) | 0.077 |

were used to identify active prescriptions for antithyroid (H03BB02), antihypertensive (C03, C04, C07, C08, C09), lipid-lowering (C10) and antidiabetic drugs (A10).

**Statistics**

Normality of distribution was confirmed by inspection of QQ-plots. Parametric data is described with means and standard deviations (SD) and tested with ANOVA when testing for differences between more than two groups and the unpaired t-test when testing between two groups. Non-parametric data is described with medians and the interquartile range (IQR) and tested with the Wilcoxon Signed Rank Test when testing for differences between more than two groups and with the Wilcoxon Mann-Whitney Test when testing for differences between two groups. Binary data is described with frequencies and 95% confidence intervals (CI) and tested using the Chi-Square Test.

Prevalence is calculated based on data on population size from Statistics Greenland [15].

Statistical analyses were performed in STATA® (version 16). A p-value less than 0.05 was considered significant.

**Ethics**

The study was approved by Health Research Ethics Committee in Greenland (KVUG 2020–18) and the health authorities in Greenland and was conducted according to the Helsinki declaration. No informed consent from the participants was needed as all data from the EMR was anonymised upon extraction.

**Results**

A total of 790 patients (66% men) were identified by either ICD10- or ICPC-code or as having a prescription for either Warfarin or Rivaroxaban. Of these, 399 (145 female and 254 male, p = 0.38) were prescribed an OAC without being classified as having AF or AFL, and 105 (28 female and 77 male, p = 0.14) patients had an AF-/AFl-classification but were not prescribed an OAC. The remaining 286 (94 female and 192 male, p = 0.78) patients were classified as having AF or AFL in the EMR and prescribed an OAC.

The estimated prevalence of AF/AFL in the Greenlandic population is shown in Table 1. We found a significant increase in prevalence for both female and male participants with advancing age (p < 0.001 when comparing participants aged <60 years with 60–69-year-old participants and participants aged 60–69 years with those aged 70 years or older) and a higher prevalence among males than females among the population younger than 70 years.

A description of all participants and a comparison of the characteristics between men and women are shown in Table 2. The comparison indicates that the female participants had a lower diastolic BP but were older and had higher cholesterol levels than the men. The female participants also had a higher prevalence of stroke, pulmonary embolism, diabetes and were more often prescribed antithyroid medication.

Among the 105 patients with a disease classification for AF or AFL and no active prescription for either Warfarin or Rivaroxaban, 21 females had a CHA2DS2-VASc score of at least two, and 56 males had a score of at least one.

**Discussion**

We found a prevalence of AF of 1.4% among the general population in Greenland. Our results contrast the prevalence of only 0.6% seen in a study based on single-point ECGs from East Greenland from 1963 [3], but the lifestyle in Greenland has changed since 1963, including levels of physical activity, smoking and dietary habits [20], as well as an increase in the life expectancy has been seen [15]. Therefore, the prevalence of AF in Greenland may have increased since 1963, but it has been shown elsewhere that prevalence calculated based on single-point ECGs is more likely to miss cases with paroxysmal AF and consequently underestimate the true prevalence of total AF [21]. Thus, as our study is based on disease classification codes and medication, it is more likely to include patients with all AF types, although our study setup only allows us to include patients already diagnosed or treated for AF and therefore misses undiagnosed patients. However, our
findings are in line with studies from other parts of the world, as the worldwide prevalence of AF in adults is estimated to be between two and four per cent [22], between one and two per cent in the Canadian and the general US population [10,23] and between 0.5% and three per cent in most low- and middle-income countries [24].

The prevalence of AF found in our study was higher among men than women, as described in other studies [25]. However, the gender difference was only prominent among those younger than 70 years. Similarly, no difference between the genders was found in the prevalence of AF among Italian nonagenarians [26], and the highest prevalence in the US was found among females older than 75 years [27]. The catching up in prevalence may be explained by the longer life expectancy among women, as the total number of women living with AF may exceed the number of men [27–29]. Moreover, with lifetime expectancies app. eight years shorter than in the US [15,30] and ten years shorter than in Denmark [31], this may become evident already at 70 years in Greenland as only five per cent of the Greenlandic population are older than 70 years [15].

Hypertension, diabetes and smoking are common in Greenland [13,14,32]. Compared to the female participants, the men in our study were more often smokers. In addition, men had lower total cholesterol, which has been found to have an inverse relationship with the risk of AF [33]. Prescriptions for antithyroid medication were more common among women, as was diabetes.

Hyperthyroidism has been found to increase the risk of AF up to 42% [34], and the odds ratio for developing AF with diabetes is between 1.4 and 1.6 for men and women, respectively [35]. Thus, although women in Greenland appear to have a lower prevalence of AF until the age of 70 years, they still carry a high burden of risk factors.

Men and women with AF have been found to have different risk profiles [36,37], and women are more likely to present atypical symptoms for AF than men, which may delay diagnosis [37]. This may also be the case in Greenland, as the difference in prevalence is not likely to be attributed to healthcare-seeking behaviour as women in Greenland have more contacts with the primary health care system than men [38]. In addition, we found that the women in our study had a higher prevalence of stroke than men. Generally, women older than 65 years with AF have a higher rate of ischaemic strokes than men with AF [29,39,40], and our results may indicate that women in Greenland more often suffer a stroke before being diagnosed with AF.

Finally, we found the minimum percentage of the study population with no prescription for OACs despite having a CHA2DS2-VASc score of at least one for men and two for women to be almost ten per cent. The setup of our study does not allow us to evaluate whether OACs were contraindicated for these patients or, for example, discontinued because of side effects, and as we were not able to include all parameters used in calculating the total CHA2DS2-VASc score, the actual percentage may be higher.

Table 2. Characteristics and comparison of the participants.

|                        | Men       | N    | Women       | N    | p-value | Total | N    |
|------------------------|-----------|------|-------------|------|---------|-------|------|
| Age, years (SD)        | 64.6 (11.3)| 523  | 68.7 (12.4) | 267  | <0.001  | 66.0  | 118.8| 790  |
| BMI, kg/m² (SD)        | 31.3 (6.9 )| 288  | 31.2 (7.0 )| 167  | 0.890   | 31.3  | 6.9  | 455  |
| Daily smokers, n (%)   | 123 (41.4)| 297  | 61 (35.3)   | 173  | 0.187   | 39.2  | 34.7 | 43.7| 470  |
| Systolic BP, mmHg (SD) | 136.5 (14.3)| 206  | 135.6 (18.8)| 142  | 0.64    | 136.1 | 16 (3.3)| 348  |
| Diastolic BP, mmHg (SD)| 83.3 (10.3)| 206  | 77.7 (9.9 )| 142  | <0.001  | 81.0  | 10.5 | 348  |
| TSH U/L (IQR)          | 0.9 (0.6;1.4)| 412  | 0.9 (0.5;1.4)| 223  | 0.154   | 0.9   | 0.6 | 1.4 | 635  |
| HbA1c, mmol/mol (IQR)  | 42 (39;46) | 483  | 43 (40;47) | 246  | 0.091   | 43    | 39.46| 729  |
| Total cholesterol, mmol/L (SD) | 4.3 (1.1) | 478  | 4.8 (1.2)  | 241  | <0.001  | 4.5   | 1.2  | 719  |
| LDL, mmol/L (SD)       | 2.3 (1.1) | 476  | 2.5 (1.2)  | 241  | 0.004   | 2.4   | 1.2  | 717  |
| HDL, mmol/L (SD)       | 1.0 (0.4) | 479  | 1.2 (0.4)  | 241  | <0.001  | 1.1   | 0.4  | 720  |
| ICD-10/ICD-codes       |           |      |             |      |         |       |      |
| AF/AFL, n (%)          | 269 (51.4)| 523  | 122 (45.7) | 267  | 0.127   | 391   | 49.5 | 790  |
| Diabetes, n (%)        | 89 (17.0) | 523  | 65 (24.3)  | 267  | 0.014   | 154   | 19.5 | 790  |
| Stroke, n (%)          | 59 (11.3) | 523  | 44 (16.5)  | 267  | 0.040   | 103   | 13.0 | 790  |
| TIA, n (%)             | 11 (2.1)  | 523  | 10 (3.8)   | 267  | 0.175   | 21    | 2.7  | 790  |
| DVT, n (%)             | 6 (1.2)   | 523  | 2 (0.8)    | 267  | 0.597   | 8     | 1.0  | 790  |
| PE, n (%)              | 0 (0.0)   | 523  | 3 (1.1)    | 267  | 0.015   | 3     | 0.4  | 790  |
| Prosthetic heart valve, n (%) | 11 (2.1) | 523  | 6 (2.3)    | 267  | 0.895   | 17    | 2.2  | 790  |
| Medication             |           |      |             |      |         |       |      |
| Warfarin, n (%)        | 55 (10.5) | 523  | 25 (9.4)   | 267  | 0.611   | 80    | 10.1 | 790  |
| Rivaroxaban, n (%)     | 391 (74.8)| 523  | 214 (80.1) | 267  | 0.091   | 605   | 76.6 | 790  |
| Antidiabetic drugs, n (%) | 64 (12.2)| 523  | 39 (14.6)  | 267  | 0.349   | 103   | 13.0 | 790  |
| Antihypertensive drugs, n (%) | 425 (81.3)| 523  | 224 (83.9) | 267  | 0.361   | 649   | 82.2 | 790  |
| Lipid-lowering drugs, n (%) | 247 (47.2)| 523  | 114 (42.7) | 267  | 0.227   | 361   | 45.7 | 790  |
| Antithyroid drugs, n (%) | 3 (0.6)  | 523  | 14 (5.2)   | 267  | <0.001  | 17    | 2.2  | 790  |
However, when comparing our results to those found by Gamra et al. in their study from 2014 [41], our results suggest a relatively high treatment rate in Greenland. Gamra et al. found that the treatment rate with OACs across 26 countries ranged between 31.7% and 66.7% among patients with a CHA2DS2-VASc score of two or more, with the highest coverage rate being in the Middle East/Africa [41]. However, as stated above, our results must be interpreted with caution.

**Strengths and limitations**

**Strengths**

Ours is the first study of the prevalence of AF among the general population in Greenland, as the EMR COSMIC is used in almost all of Greenland and covers 96% of the population. It is also the first study of AF in Greenland based on OAC-prescription and disease classification codes, including patients diagnosed in different settings.

**Limitations**

First and foremost, we may have missed some patients diagnosed with AF, as disease classification has not been done consequently in Greenland’s primary health care sector but has become a point of focus in recent years. However, including prescription history and other diagnoses requiring OACs enables us to identify most patients with AF, as ICD-10 disease classification codes are registered in the EMR when discharging patients from the hospital, as are all prescriptions from primary and secondary health care sectors.

This setup only allows us to include patients diagnosed, registered or medically treated as having AF. The number of undiagnosed Greenlanders with AF remains unknown and must be explored using different methods. In addition, as some included patients had multiple ICD-10 codes for AF type and the ICPC codes does not specify which kind of AF the patient is suffering from, it is not possible to give an accurate estimation of the distribution of paroxysmal AF, chronic AF and persistent AF among the included patients.

Our results do not offer any estimations on possible genetic effects on the prevalence of AF in Greenland, as COSMIC covers all residents with a permanent address in Greenland, including residents of other nationalities and ethnicities. The risk factors for AF are extracted after the participant was either diagnosed with AF or had started treatment with an OAC. This may cause us to over- or underestimate the prevalence of the included risk factors regarding AF, as some conditions may no longer have been present or treated at the time of the study, and some may have occurred or started treatment after the diagnosis of AF were given.

Finally, our data does not include information on congestive heart failure or vascular disease; however, our data allows us to estimate a minimum number of patients with a CHA2DS2-VASc score above zero for males and one for females, and consequently a minimum number of potentially undertreated patients.

**Conclusion**

In conclusion, we found a prevalence of AF and a pattern of AF comparable to other Western countries. Our findings suggest that AF poses the same challenges in Greenland as elsewhere, as Greenland’s life expectancy and the prevalence of risk factors is increasing. Early detection and timely treatment with OACs should be a point of focus in the future to decrease the risk of stroke and AF-related morbidity and -mortality, and further studies should evaluate whether AF and AFL carry the same disease burden in Greenland as elsewhere.

**Disclosure statement**

No potential conflict of interest was reported by the author(s).

**Funding**

The project was supported by Karen Elise Jensen’s Foundation and the Novo Nordisk Foundation under grant NNF20SA0064190.

**ORCID**

N Albertsen http://orcid.org/0000-0002-6774-9492
S Riahi http://orcid.org/0000-0003-1849-9463
S Andersen http://orcid.org/0000-0003-3632-5213

**References**

[1] Senftleber NK, Albrectsen A, Lauritzen L, et al. Omega-3 fatty acids and risk of cardiovascular disease in Inuit: first prospective cohort study. Atherosclerosis. 2020 Nov;312:28–34.

[2] Jørgensen ME, Bjerregaard P, Kjærgaard JJ, et al. High prevalence of markers of coronary heart disease among Greenland Inuit. Atherosclerosis. 2008 Feb;196 (2):772–778.

[3] Kjærgaard M, Andersen S, Holten M, et al. Low occurrence of ischemic heart disease among Inuit around 1963
suggested from ECG among 1851 East Greenland Inuit. Atherosclerosis. 2009 Apr;203(2):599–603.

[4] Bjorn-Mortensen K, Lynggaard F, Pedersen ML. High prevalence of atrial fibrillation among Greenlanders with ischemic stroke - atrial fibrillation found in more than 30% of cases. Int J Circumpolar Health. 2013 Nov 22;72 (1):22628.

[5] Romero JR, Wolf PA. Epidemiology of stroke: legacy of the Framingham Heart Study. Glob Heart. 2013 Mar 1;8 (1):67–75.

[6] Wolf PA, Abbott RD, Kannel WB. Atrial fibrillation as an independent risk factor for stroke: the Framingham Study. Stroke. 1991 Aug;22(8):983–988.

[7] Atzema CL, Khan S, Lu H, et al. Cardiovascular disease rates, outcomes, and quality of care in Ontario Métis: a population-based cohort study. PLoS One. 2015 Mar 20;10(3):e0121779.

[8] Wong CX, Brooks AG, Cheng YH, et al. Atrial fibrillation in Indigenous and non-Indigenous Australians: a cross-sectional study. BMJ Open. 2014 Oct 24;4(10): e006242.

[9] Sanchez JM, Jolly SE, Dewland TA, et al. Incident atrial fibrillation among American Indians in California. Circulation. 2019 Nov 5;140(19):1605–1606.

[10] Ugowe FE, Jackson ILR, Thomas KL. Racial and ethnic differences in the prevalence, management, and outcomes in patients with atrial fibrillation: a systematic review. Heart Rhythm. 2018 Sep;15(9):1337–1345.

[11] Amponsah MKD, Benjamin EJ, Magnani JW. Atrial fibrillation and race - a contemporary review. Curr Cardiovasc Risk Rep. 2013 Oct;7(5):336–345.

[12] Chalazan B, Mol D, Darbar FA, et al. Association of rare genetic variants and early-onset atrial fibrillation in ethnic minority individuals. JAMA Cardiol. 2021 Jul 1;6 (7):811–819.

[13] Viskum C, Larsen L, Hansen CB, et al. Befolkning sundesøgelsen i Grønland 2018. Levevilkår, livsstil og helbred. [The Population Survey in Greenland 2018. Living Conditions, Life Style and Health. Danish. [cited 2021 Jul 5] Available from: Befolkningssundesøgelsen i Grønland 2018. Levevilkår, livsstil og helbred (stud.dk).

[14] Bundgaard M, Jarbøl DE, Paulsen MS, et al. Prevalence of the use of antihypertensive medications in Greenland: a study of quality of care amongst patients treated with antihypertensive drugs. Int J Circumpolar Health. 2012;71 (1):18834.

[15] Statistics Greenland. Expected lifetime 2000–2020. [cited 2022 Jan 4]. Available from: https://bank.stat.gl:443/api/v1/da/Greenland/BE/BE10/BE20/BEX8BDDTB.px.

[16] Tvermosegaard M, Rønne PF, Pedersen ML, et al. Validation of cardiovascular diagnoses in the Greenlandic Hospital discharge register for epidemiological use. Int J Circumpolar Health. 2018 Dec;77 (1):1422668.

[17] Lip GYH, Halperin JL. Improving stroke risk stratification in atrial fibrillation. Am J Med. 2010 Jun;123(6):484–488.

[18] Hart RG, Benavente O, McBride R, et al. Antithrombotic therapy to prevent stroke in patients with atrial fibrillation: a meta-analysis. Ann Intern Med. 1999 Oct 5;131 (7):492–501.

[19] Ruff CT, Giugliano RP, Braunwald E, et al. Comparison of the efficacy and safety of new oral anticoagulants with warfarin in patients with atrial fibrillation: a meta-analysis of randomised trials. Lancet. 2014 Mar 15;383 (9921):955–962.

[20] Senftleber NK, Overvad M, Dahl-Petersen IK, et al. Diet and physical activity in Greenland: genetic interactions and associations with obesity and diabetes. Appl Physiol Nutr Metab. 2021 Aug;46(8):849–855.

[21] Seni A, Karna S, Fahey N, et al. Age-and-sex stratified prevalence of atrial fibrillation in Rural Western India: results of SMARTIndia, a population-based screening study. Int J Cardiol. 2019 Apr 1;280:84.

[22] Hindricks G, Potpara T, Dagres N, et al. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS): the Task Force for the diagnosis and management of atrial fibrillation of the European Society of Cardiology (ESC) Developed with the special contribution of the European Heart Rhythm Association (EHRA) of the ESC. Eur Heart J. 2021 Feb 1;42(5):373–498.

[23] Katzenellenbogen JM, Woods JA, Teng THK, et al. Atrial fibrillation in the Indigenous populations of Australia, Canada, New Zealand, and the USA: a systematic scoping review. BMC Cardiovasc Disord. 2015 Aug;13(15):1:87.

[24] Santos IS, Goulart AC, Olmos RD, et al. Atrial fibrillation in low- and middle-income countries: a narrative review. Eur Heart J Suppl. 2020 Dec 22;22(Supplement_O):O61–O77.

[25] Lip GY, Brechin CM, Lane DA. The global burden of atrial fibrillation and stroke: a systematic review of the epidemiology of atrial fibrillation in regions outside North America and Europe. Chest. 2012 Dec;142(6):1489–1498.

[26] Tsialtas D, Bolognesi MG, Assimopoulos S, et al. Clinical, electrocardiographic, and echocardiographic features in hospitalized nonagenarians (90+): comparison between the genders. Gerontolology. 2019;65(5):485–494.

[27] Feinberg WM, Blackshear JL, Laupacis A, et al. Prevalence, age distribution, and gender of patients with atrial fibrillation: analysis and implications. Arch Intern Med. 1995 Mar 13;155(5):469–473.

[28] Schnabel RB, Yin X, Gona P, et al. 50 year trends in atrial fibrillation prevalence, incidence, risk factors, and mortality in the Framingham Heart Study: a cohort study. Lancet. 2015 Jul 11;386(9989):154–162.

[29] Ko D, Rahman F, Schnabel RB, et al. Atrial fibrillation in women: epidemiology, pathophysiology, presentation, and prognosis. Nat Rev Cardiol. 2016 Jun;13(6):321–332.

[30] Arias E, Xu J. USA Life Tables, 2018. Natl Vital Stat Rep. 2020 Nov;69(12):1–45.

[31] OECD. Health status - Life expectancy at birth [Internet]. [cited 2022 Jan 5]. Available from: https://data.oecd.org/healthstat/life-expectancy-at-birth.htm.

[32] Reiss AE, Pedersen ML. Smoking among patients in the primary health care system in Nuuk, Greenland. Clin Nurs Stud. 2014;2:74.

[33] Magnussen C, Niiranen TJ, Ojeda FM, et al. Sex differences and similarities in atrial fibrillation epidemiology, risk factors, and mortality in community cohorts: results from the biomarcare consortium (Biomarker for cardiovascular risk assessment in Europe). Circulation. 2017 Oct 24;136(17):1588–1597.

[34] Selmer C, Olesen JB, Hansen ML, et al. The spectrum of thyroid disease and risk of new onset atrial fibrillation:
a large population cohort study. BMJ. 2012 Nov 27;345 (nov27 1):e7895.

[35] Westerman S, Wenger N. Gender differences in atrial fibrillation: a review of epidemiology, management, and outcomes. Curr Cardiol Rev. 2019;15(2):136–144.

[36] Ball J, Carrington MJ, Wood KA, et al. Women versus men with chronic atrial fibrillation: insights from the Standard versus Atrial Fibrillation spEcific managemenT study (SAFETY). PLoS One. 2013 May 29;8(5):e65795.

[37] Scheuermeyer FX, Mackay M, Christenson J, et al. There are sex differences in the demographics and risk profiles of emergency department (ED) patients with atrial fibrillation and flutter, but no apparent differences in ED management or outcomes. Acad Emerg Med. 2015 Sep;22(9):1067–1075.

[38] Pedersen ML, Rolskov AR, Jacobsen JL, et al. Frequent use of primary health care service in Greenland: an opportunity for undiagnosed disease case-finding. Int J Circumpolar Health. 2012 Jul 24;71(1):18431.

[39] O’Neal WT, Alam AB, Sandesara PB, et al. Sex and racial differences in cardiovascular disease risk in patients with atrial fibrillation. PLoS One. 2019 Sep 4;14(9):e0222147.

[40] Rathfoot C, Edrissi C, Sanders CB, et al. Gender differences in comorbidities and risk factors in ischemic stroke patients with a history of atrial fibrillation. BMC Neurol. 2021 May 25;21(1):209.

[41] Gamra H, Murin J, Chiang CE, et al. Use of antithrombotics in atrial fibrillation in Africa, Europe, Asia and South America: insights from the International RealiseAF Survey. Arch Cardiovasc Dis. 2014 Feb;107(2):77–87.