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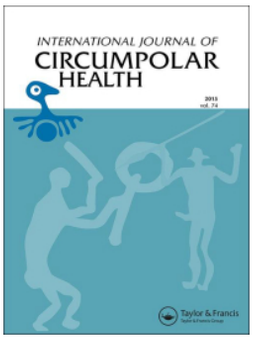

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Quality of care among patients diagnosed with atrial fibrillation in Greenland

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ABSTRACT

This cross-sectional study sought to assess the prevalence of atrial fibrillation (AF) diagnosis in Greenland among various age groups and examine the corresponding quality of care. We collected data from Greenland's electronic medical records and evaluated the quality of care using six internationally recommended indicators, which are: percentage of AF patients with an assessment of smoking status within the previous year, an assessment of body mass index within the previous year, assessment of blood pressure within the previous year, measurement of thyroid stimulating hormone (TSH), treatment with an anticoagulant and percentage of patients with a measurement of serum-creatinine. We found the prevalence of AF among patients aged 20 years or older in Greenland to be 1.75% (95% CI 1.62–1.88). We found an increasing prevalence of AF with age and a greater proportion of men than women until the age of 74 years. Our study suggests that the associated quality of care could be higher as the requirement of only one of the six quality indicators was met. A lack of registration may partly explain this, and initiatives to improve the quality of care are recommended.

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Introduction

Atrial fibrillation (AF) is a supraventricular tachyarrhythmia with uncoordinated atrial electrical activation and, consequently, ineffective atrial contraction [1]. As the most common arrhythmia in clinical practice, AF is associated with increased cardiovascular morbidity and mortality [2,3]. The worldwide prevalence of atrial fibrillation (AF) in adults is estimated to be 2–4% [4]; however, there may be ethnic differences in the prevalence of AF, possibly due to genetics [5–7]. A study from 2022 found that American Indians and Alaska Natives had the highest risk of AF and AF-related stroke compared with other racial and ethnic groups [8], and a systematic scoping review of AF among the indigenous populations of Australia, Canada, New Zealand, and the United States found no clear pattern of AF frequency, given the limited available evidence [9]. Nonetheless, a study conducted in 2022 [10], relying on diagnosis codes and the administration of anticoagulants, reported that the prevalence of AF in Greenland stood at 1.4%, aligning closely with AF prevalence rates observed in other Western countries [11]. After this study, all patients receiving anticoagulant treatment underwent review and were registered with an AF diagnosis code if deemed appropriate.

The global prevalence of AF is expected to increase further owing to the prevalence of well-known risk factors such as smoking, obesity, hypertension, diabetes [1], and, most significantly, increasing life expectancy. Life expectancy in Greenland is estimated to be longer than that of other indigenous people [12], but significantly shorter than that in Western countries and approximately 10 years shorter than that in Denmark [13,14]. In addition, approximately half of the Greenlandic population are current smokers, and obesity is an increasing challenge in the Greenlandic healthcare system [13,15,16], as well as hypertension and diabetes [13,15,17].

Monitoring prevalence and quality may affect the quality of care in clinical practice. Diabetes has been monitored in Greenland since 2008, and frequent evaluations of the quality of care has led to significant improvements in both short- and long-term quality of

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care [18,19]. Similarly, a lower quality of care has been observed in diseases which are not monitored as closely in Greenland, e.g. hypertension, chronic obstructive pulmonary disease (COPD), and asthma [17,20,21] and these studies have led to increased focus on registration of diagnosis codes and treatment. It is, therefore, essential to know the prevalence and the quality of AF to ensure quality of care.

In this study, we aim to estimate the age-specific prevalence of people diagnosed with AF and describe the prevalence of well-established AF risk factors among patients. In addition, we evaluate the quality of care of patients diagnosed with AF in Greenland based on a list of quality indicators available to clinicians in the Greenlandic healthcare system.

Materials and methods

Study design

This cross-sectional study describes the age-specific prevalence of diagnosed AF in Greenland and the associated quality of care. Data were obtained from the Greenlandic electronic medical record (EMR) on 8 March 2023.

Setting

The population of Greenland ($n = 56{,}000$) [22] lives in towns and settlements along the west, east, and south coasts. Although originating from North America, approximately 80% of the present-day Greenlandic population have European ancestry. The admixture is less pronounced in the more remote areas, such as North and East Greenland, but on average, the Greenlanders have 25% European ancestry [23].

Greenland is divided into five healthcare regions, each with a regional hospital. Healthcare centres and units are placed in smaller towns and settlements and 83.7% of the population is in contact with the primary health care system each year [24]. Hospitals and larger health care centres are staffed with physicians whenever possible; however, recruitment is a challenge in Greenland. The turnover of medical doctors and health personnel in general in Greenland is high, and only a few towns have permanent doctors.

Diagnosis codes are registered by medical doctors at discharge and at visits in the outpatient clinic in QIH. In the health care centre in Nuuk, diagnosis codes are registered by nurses or doctors following phone consultations and visits. Approximately 74% of the patients in Nuuk and 26% of the patients outside of Nuuk are assigned a diagnosis code [24].

Health care, medication, and primary dental care are free of charge for all residents, and the health care system is publicly funded.

The largest hospital, Queen Ingrid's Hospital (QIH) in located in the capital, Nuuk, where approximately 19,000 residents live. The specialised treatment of AF takes place in QIH, and AF patients in rhythm control are seen annually by a cardiologist, while the local physician sees patients in rate control in the local region.

In line with international recommendations, the local clinical guidelines in Greenland state that AF must be verified by electrocardiogram (ECG) or a Holter recording. AF is registered in the EMR at discharge or at visits in the outpatient clinic in QIH.

Study population and variables

Data on population size by age and gender were extracted from Statistics Greenland [22] and included permanent residents in Greenland. Demographic data and data on the diagnosis codes, risk factors, comorbidities, and medications were extracted from the EMR.

The study population consisted of residents aged 20 years or above diagnosed with AF. The background population contains all residents aged 20 years or above as of 1 January 2023, except for residents from Tasiilaq, where the EMR still needs to be fully implemented.

The inclusion criterion was a registered AF diagnosis by Classification of Primary Care Codes (ICPC2) K78 at Queen Ingrid's Health Care Centre or by International Classification of Diseases codes, 10th revision (ICD −10) I48.

Extracted information included age, sex, height, weight, BMI (or height and weight), smoking status (daily smoker yes/no), blood pressure (mmHg) (home blood pressure if any, if not available, then the newest blood pressure measured in a consultation), thyroid-stimulating hormone (TSH), glycated haemoglobin (HbA1c), cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglycerides, creatinine, and anticoagulative treatment (by ATC code). Conclusions from the newest echocardiography (LVEF) and CHA_2DS_2-VASc score were also extracted. The CHA_2DS_2-VASc score has only been possible to register in the clinical scorecard in the EMR since January 2023.

Data on comorbidities were extracted using medical diagnosis codes (ICPC2/ICPD 10): diabetes (T89, T90/E10.0-E10.9, E11.0-E11.9, E12, E13, E14), stroke (K90/I619, I631-I639, I649), hypertension (K85, K86, K87/I109, I10, I119A, I159), heart failure (HF) (K77/I11.0, I13.0, I42.0, I42.6, I42.7, I42.9, I50.0-I50.9), ischaemic heart disease (K74, K75, K76/I20, I20.9 I21, I22, I23, I24, I25), and hyperthyroidism (T85, T86/E05).

Table 1. Quality indicators*.

Percentage of patients in whom smoking status was assessed within the previous year
Percentage of patients in whom BMI was measured within the previous year?
Percentage of patients in whom blood pressure was measured within the previous year
Percentage of patients in whom a TSH was measued
Percentage of patients in treatment with anticoagulation medication
Percentage of patients in whom a serum creatinine level was measured

BMI = body mass index. TSH = Thyroid-Stimulating Hormone.
**Quality indicators adapted to the Greenlandic context based on guidelines from European Society of Cardiology (ESC) [1] and from The Danish Clinical Quality Program – National Clinical Registries (RKKP) [25].*

Table 1 presents the quality indicators for the AF treatment in Greenland. Quality indicators were developed at the Steno Diabetes Centre Greenland with inspiration from the European Society of Cardiology (ESC) and The Danish Clinical Quality Program – National Clinical Registries (RKKP) [1,25]. It was not feasible to incorporate all the recommended indicators per the guidelines because our data does not provide precise information on when the diagnoses were initially made.

Statistical analysis

Parametric data, in which the normality of distribution was confirmed using histograms, were described using means and standard deviations (SD). Differences between the two groups were tested using Student's t-test. Medians and interquartile range (IQR) were used when describing non-parametric Wilcoxon Mann-Whitney Test was used to test for differences between the two groups. Binary data were tested using the Chi-Squared test and are described as frequencies. Data on population size was obtained from Statistics Greenland and was used to calculate prevalence. Statistical analyses were performed in R, version 4.2.2.

P-values less than 0.05 was considered significant for all analysis. The study was approved by The Science Ethics Committee in Greenland (reference no. KVUG 2020–18) and by The Agency for Health and Prevention in Greenland. All data were anonymised upon extraction.

Results

Basic characteristics

The basic characteristics of the study population are summarised in Table 2. We identified 696 patients with AF (67% men), with a mean age of 67 years and a BMI of 31 kg/m^2. Thirty-six per cent were daily smokers, and half were diagnosed with hypertension. Men were significantly younger, heavier, and taller than women. Furthermore, men had significantly higher diastolic blood pressure and creatinine levels than women. Women had significantly higher levels of total cholesterol, HDL, TSH, and triglycerides than men. Significantly more men than women suffered from HF and ischaemic heart disease, whereas more women

Table 2. Basic characteristics of patients diagnosed with AF in Greenland in 2023.

	Men	N	Women	N	*p*	Total	N
Age, years (SD)	66 (11.1)	469	70 (11.7)	227	**<0.001**	67 (11.5)	696
Height, cm (SD)	170 (8.5)	386	156 (7.8)	197	**<0.001**	165 (10.6)	583
Weight, kg (SD)	88 (21.7)	410	72 (18.6)	211	**<0.001**	83 (22.0)	621
BMI, kg/m^2 (SD)	30.6 (6.8)	384	30.1 (7.1)	197	0.386	30.5 (6.9)	581
Daily smokers, N (%) (95% CI)	110 (32) (27.37)	347	58 (31) (24.37)	189	0.809	168 (36) (31.40)	472
Systolic BP, mmHg (SD)	133 (16.9)	374	135 (18.0)	191	0.252	134 (17.3)	565
Diastolic BP, mmHg (SD)	81 (11.0)	374	76 (10.0)	191	**<0.001**	79 (10.9)	565
TSH U/L, (IQR)	1.30 (0.74;1.54)	381	1.35 (0.55;1.56)	195	**0.036**	1.32 (0.69;1.55)	576
HbA1c, mmol/mol (IQR)	43 (39;46)	440	43 (38;46)	217	0.979	43 (38;46)	657
Total cholesterol, mmol/l (SD)	4.39 (1.13)	425	4.79 (1.18)	208	**<0.001**	4.52 (1.16)	633
LDL, mmol/L (SD)	2.56 (1.06)	425	2.73 (1.17)	208	0.062	2.62 (1.10)	633
HDL, mmol/L (SD)	1.27 (0.47)	426	1.41 (0.44)	208	**<0.001**	1.31 (0.47)	634
LVEF % (SD)	43 (12.7)	114	46 (14.0)	32	0.341	44 (13.0)	146
Triglycerides, mmol/L (IQR)	1.9 (1.1;2.3)	426	2.2 (1.2;2.5)	208	**0.029**	2.0 (1.2;2.4)	634
Creatinine, µmol/L (IQR)	98.8 (79;107)	460	84.4 (66;86)	224	**<0.001**	94.1 (75;103)	684
Comorbidity							
Diabetes, n (%) (95% CI)	96 (20) (17.24)	469	58 (26) (20.31)	227	0.130	154 (22) (19.25)	696
Stroke, n (%) (95% CI)	64 (14) (11.17)	469	43 (19) (14.24)	227	0.069	107 (15) (13.18)	696
Hypertension, n (%) (95% CI)	212 (45) (41.50)	469	134 (59) (53–65)	227	**<0.001**	346 (50) (46.53)	696
Heart failure, n (%) (95% CI)	128 (27) (23.31)	469	38 (17) (12.22)	227	**0.002**	166 (24) (21.27)	696
Ischemic heart disease, n (%) (95% CI)	80 (17) (14.20)	469	23 (10) (6.14)	227	**0.016**	103 (15) (12.17)	696
Hyperthyroidism, n (%) (95% CI)	3 (0.6) (−0.1–1.4)	469	12 (5.3) (2.4–8.2)	227	**<0.001**	15 (2.2) (1.1–3.2)	696
Medication							
Anticoagulation medication, n (%) (95% CI)	379 (81) (77–84)	469	191 (84) (79–89)	227	0.285	570 (82) (79.85)	696
Warfarin, n (%) (95% CI)	32 (7) (5.9)	469	8 (4) (1.6)	227	0.080	40 (6) (4.7)	696
Rivaroxaban, n (%) (95% CI)	347 (74) (70–78)	469	183 (81) (75–86)	227	0.054	530 (76) (73–79)	696
Apixaban, n (%) (95% CI)	2 (0.4) (−0.2–0.9)	469	3 (1.1) (−0.1–2.4)	227	0.206	5 (0.6) (0.1–1.2)	696

p values below 0.05 are in bold. BMI = body mass index. TSH = Thyroid-Stimulating Hormone. HbA1c = Haemoglobin A1c. LDL = low density-lipoprotein. HDL = high density-lipoprotein. LVEF = Left Ventricular Ejection Fraction. IQR = interquartile range. CI = confidence interval.

than men suffered from hyperthyroidism. HF and diabetes were found in nearly one out of four patients with AF.

Prevalence

The prevalence of people aged 20 years or above diagnosed with AF in Greenland was 1.75% (95% CI 1.62–1.88). Table 3 shows the age- and sex-specific prevalence of people diagnosed with AF in Greenland by 2023. The overall prevalence was significantly higher among men than women ($p < 0.001$), and AF was more prevalent among men than women younger than 40 years and between 55 and 75 years. The prevalence increased with age.

Quality of care

Table 4 shows the quality of care for patients with AF according to gender in 2023. We found gender-related differences in three of the specific indicators. Significantly more women had a TSH measurement performed and smoking status assessed within the previous year compared to men. An echocardiography was performed in 146 patients, while 25 patients had a CHA_2DS_2-VASc score registered (data not shown).

There was no increase in the quality of care with age, as shown in Table 5. However, our results indicate that the quality of care is higher among patients with diabetes regarding smoking assessment, measurement of BMI and blood pressure and treatment with and anticoagulation (all $p < 0.001$, Table S1). Comparisons of the quality of care between patients with and without hypertension, stroke, ischaemic heart disease, heart failure and hyperthyroidism are shown in tables S2-S6.

Discussion

The total prevalence of diagnosed AF among adults in our study was 1.75%. This is an increase compared with the prevalence of 1.4% in 2021, as described by some of this paper's authors in 2022 [10]. However, the methods used in our studies differ slightly, and after the study from 2021, all patients in anticoagulation treatment in Greenland have been evaluated and registered with an AF diagnosis code if relevant. Also, the study from 2022 included children, which might skew the results as AF is less common among children, and approximately 25% of the Greenlandic population was younger than 20

Table 3. The prevalence of patients diagnosed with AF in Greenland in 2023.

	Men *(95% CI) (n/N)*	Women *(95% CI) (n/N)*	*p*	Total *(95% CI) (n/N)*
Prevalence among adults ≥20 years of age	2.21 (2.02–2.41) (469/21,181)	1.22 (1.06–1.38) (227/18,582)	**<0.001**	1.75 (1.62–1.88) (696/39,763)
Prevalence in age groups				
20–39	0.14 (0.06–0.22) (12/8,516)	0.02 (−0.01–0.06) (2/8,020)	**0.010**	0.08 (0.04–0.13) (14/16,536)
40–44	0.66 (0.29–1.04) (12/1,812)	0.19 (−0.02–0.40) (3/1,584)	**0.038**	0.44 (0.22–0.66) (15/3,396)
45–49	0.57 (0.20–0.94) (9/1,573)	0.33 (0.01–0.65) (4/1,224)	0.344	0.46 (0.21–0.72) (13/2,797)
50–54	1.27 (0.75–1.78) (23/1,818)	0.58 (0.20–0.96) (9/1,545)	**0.042**	0.95 (0.62–1.28) (32/3,363)
55–59	2.27 (1.69–2.85) (57/2,510)	1.05 (0.61–1.48) (22/2,103)	**0.001**	1.71 (1.34–2.09) (79/4,613)
60–64	4.34 (3.46–5.21) (90/2,075)	1.84 (1.20–2.48) (31/1,688)	**<0.001**	3.22 (2.65–3.78) (121/3,763)
65–69	7.05 (5.69–8.42) (95/1,347)	2.75 (1.77–3.74) (29/1,053)	**<0.001**	5.17 (4.28–6.05) (124/2,400)
70–74	9.31 (7.28–11.35) (73/784)	5.03 (3.27–6.78) (30/597)	**0.003**	7.46 (6.07–8.84) (103/1381)
75–79	11.42 (8.53–14.32) (53/464)	10.07 (7.18–12.96) (42/417)	0.519	10.78 (8.74–12.83) (95/881)
80–84	13.40 (8.78–18.02) (28/209)	14.16 (9.61–18.70) (32/226)	0.818	13.79 (10.55–17.03) (60/435)
85+	23.29 (13.59–32.98) (17/73)	18.40 (11.61–25.19) (23/125)	0.409	20.20 (14.61–25.79) (40/198)

n/N, number of patients/population. P-values below 0.05 are in bold.

Table 4. Quality of care among patients diagnosed with AF in Greenland in 2023.

	Men *(95% CI) (n/N)*	Women *(95% CI) (n/N)*	*p*	Total *(95% CI) (n/N)*
Patients in whom smoking status was assessed within the previous year	40.5 (36.1–45.0) (190/469)	49.8 (43.3–56.3) (113/227)	**0.021**	43.5 (39.9–47.2) (303/696)
Patients in whom BMI was measured within the previous year	45.2 (40.7–49.7) (212/469)	51.1 (44.6–57.6) (116/227)	0.144	47.1 (43.4–50.8) (328/696)
Patients in whom blood pressure was measured within the previous year	40.9 (36.5–45.4) (192/469)	41.4 (35.0–47.8) (94/227)	0.906	41.1 (37.4–44.8) (286/696)
Percentage of patients in whom a TSH was measured	81.5 (77.9–85.0) (382/469)	88.1 (83.9–92.3) (200/227)	**0.026**	83.6 (80.9–86.4) (582/696)
Patients in treatment with anticoagulation medication	80.8 (77.3–84.4) (379/469)	84.1 (79.4–88.9) (191/227)	0.285	84.8 (82.1–87.4) (590/696)
Patients in whom a serum creatinine level was measured	98.1 (96.8–99.3) (460/469)	98.7 (97.2–100.2) (224/227)	0.570	98.3 (97.3–99.2) (684/696)

n/N, number of patients/population. P-values below 0.05 are in bold. BMI = body mass index. TSH = Thyroid-Stimulating Hormone.

Table 5. Quality of care in age groups.

	Smoking status *(95% CI) (n/N)*	BMI *(95% CI) (n/N)*	Blood pressure *(95% CI) (n/N)*	TSH *(95% CI) (n/N)*	Anticoagulation medication *(95% CI) (n/N)*	Serum creatinine level *(95% CI) (n/N)*
20–39	14.3 (−4.0–32.6) (2/14)	21.4 (−0.1–42.9) (3/14)	21.4 (−0.1–42.9) (3/14)	78.6 (57.1–100.1) (11/14)	57.1 (31.2–83.1) (8/14)	78.6 (57.1–100.1) (11/14)
40–44	33.3 (9.5–57.2) (5/15)	46.7 (21.4–71.9) (7/15)	53.3 (28.1–78.6) (8/15)	80.0 (59.8–100.2) (12/15)	46.7 (21.4–71.9) (7/15)	93.3 (80.7–106.0) (14/15)
45–49	15.4 (−4.2–35.0) (2/13)	30.8 (5.7–55.9) (4/13)	38.5 (12.0–64.9) (5/13)	92.3 (77.8–106.8) (12/13)	76.9 (54.0–99.8) (10/13)	100.0 (100.0–100.0) (13/13)
50–54	28.1 (12.5–43.7) (9/32)	34.4 (17.9–50.8) (11/32)	25.0 (10.0–40.0) (8/32)	71.9 (56.3–87.5) (23/32)	71.9 (56.3–87.5) (23/32)	90.6 (80.5–100.7) (29/32)
55–59	39.2 (28.5–50.0) (31/79)	46.8 (35.8–57.8) (37/79)	35.4 (24.9–46.0) (28/79)	87.3 (80.0–94.7) (69/79)	87.3 (80.0–94.7) (69/79)	97.5 (94.0–100.9) (77/79)
60–64	47.1 (38.2–56.0) (57/121)	48.8 (39.9–57.7) (59/121)	43.0 (34.3–51.8) (52/121)	90.1 (84.8–95.4) (109/121)	86.8 (80.7–92.8) (105/121)	100.0 (100.0–100.0) (121/121)
65–69	38.7 (30.1–47.3) (48/124)	46.8 (38.0–55.6) (58/124)	40.3 (31.7–49.0) (50/124)	85.5 (79.3–91.7) (106/124)	79.8 (72.8–86.9) (99/124)	100.0 (100.0–100.0) (124/124)
70–74	50.5 (40.8–60.1) (52/103)	51.5 (41.8–61.1) (53/103)	41.7 (32.2–51.3) (43/103)	79.6 (71.8–87.4) (82/103)	84.5 (77.5–91.5) (87/103)	100.0 (100.0–100.0) (103/103)
75–79	62.1 (52.3–71.9) (59/95)	62.1 (52.3–71.9) (59/95)	55.8 (45.8–65.8) (53/95)	77.9 (69.6–86.2) (74/95)	86.3 (79.4–93.2) (82/95)	97.9 (95.0–100.8) (93/95)
80–84	46.7 (34.0–59.3) (28/60)	41.7 (29.2–54.1) (25/60)	36.7 (24.5–48.9) (22/60)	91.7 (84.7–98.7) (55/60)	76.7 (66.0–87.4) (46/60)	98.3 (95.1–101.6) (59/60)
85+	25.0 (11.6–38.4) (10/40)	30.0 (15.8–44.2) (12/40)	35.0 (20.2–49.8) (14/40)	72.5 (58.7–86.3) (29/40)	85.0 (73.9–96.1) (34/40)	100.0 (100.0–100.0) (40/40)

n/N, number of patients/population. P-values below 0.05 are in bold.

years in 2021 [22]. We found considerably similar results when comparing the prevalence of AF in our study with that in other indigenous populations. A small study of 436 Australian Aboriginals found a prevalence of AF of 2.5% [26], and a conference abstract reported the prevalence of AF among Canadian Aboriginals to be 2.1% [27]. The prevalence found in our study was also similar to that found in three European countries (Italy (1.9%), Germany (2.3%), and England (1.9%)) [11]. In Nordic countries, the prevalence of AF tended to be slightly higher than what we observed in our study, except in Iceland, where it was 1.9% [11]. Specifically, Denmark reported an estimated prevalence of 3.0% among individuals aged 18 years or older by the end of 2018, based on all hospital contacts [28]. In 2014, the prevalence of AF in the adult Norwegian population was estimated to be 3.4% [29]. Additionally, Finland recorded a prevalence of 5.2% in 2018 [30], while Sweden reported a prevalence of 2.9% [11].

We observed a rise in AF prevalence with advancing age, and it was more common in men than women, except among the oldest patients. These findings align with similar trends observed in other studies, both on a global scale [31–33] and within the context of Greenland [10]. The highest prevalence in our study (20%) was found among people aged 85 years or above, which was comparable to the same age group in Denmark in 2018 with a prevalence of 21% [34,35] but lower than the prevalence of 30% reported in Finland [30]. AF tends to manifest in indigenous Māori communities in New Zealand approximately 10–20 years earlier than in the non-indigenous population. Similarly, it was reported that among Sami people (indigenous individuals from Northern Norway), AF typically debuts about seven years earlier than in non-Sami populations [27]. Since we have an age-specific prevalence comparable Denmark's, we do not seem to find the same in our study.

The Framingham study showed that the risk of developing AF increased with age (odds ratio (OR) 2.1 for men, 2.2 for women for each decade), diabetes (OR, men: 1.4, women:1.6), hypertension (OR, men: 1.5, women: 1.4), and HF (OR, men: 4.5, women: 5.9) [36]. In addition, a review including 84 reports of cardiovascular risk factors for incident AF found a direct association between hypertension and AF, and six reports described a direct association between diabetes and AF [37]. These risk factors were also common among our study population compared to the general Greenlandic population. Half of the patients in our study were diagnosed with hypertension, 25% were diagnosed with diabetes, and 2% had HF. In comparison, 17.5% of the Greenlandic population received antihypertensive medication, and 7.9% had a registered diagnosis code for hypertension in 2016 [17]. The prevalence of diagnosed diabetes in the Greenlandic background population aged 20 years or older was 3.7% in 2020 [18]. Larsen et al. estimated the prevalence of HF to be 1.1% in the Greenlandic population aged 16 years or above [38].

Obesity is another well-known risk factor for AF [4,39,40], as well as smoking [41] and hyperthyroidism [42]. Our study population had a mean BMI of 31 kg/m^2, which is higher than the BMI of the background population in Greenland (29 kg/m^2) [43]. However, smoking and hyperthyroidism were less common among the patients with AF in our study than among the general Greenlandic population. Thirty-six per cent of our study population were registered as daily smokers, whereas 49% were registered as daily smokers in Greenland in the background population [43]. Finally, 2.2% of the patients were diagnosed with hyperthyroidism, which affects 4.3% of non-Inuit Greenlanders and 7.8% to 10.7% of Inuit Greenlanders [44].

We evaluated the quality of care for people with AF by estimating registration rates of selected quality indicators (Table 4). Guidelines presented by the ESC and RKKP require measurements to be taken within a certain number of days after diagnosis [1,25]. However, it must be considered in the following discussion of guidelines and the assessed quality of care of people diagnosed with AF in Greenland that we do not know the exact date the diagnoses were made in our study population.

In our study, the overall quality of care was found to be suboptimal. In Denmark, there has been a noted improvement in the quality of care for AF patients over time [25]. Nonetheless, comparing the quality of care between the two countries in detail is challenging due to the greater level of detail in Denmark's care quality indicators, which surpasses those used in Greenland.

Smoking status was assessed in 43.5% of the patients. This is much lower than a recently published study from Greenland investigating the quality of care among people with COPD, which found smoking status to be assessed in 63.9% of patients within the previous year [21] but is comparable to the results of the evaluation of the quality of care among patients with hypertension in Greenland (44.1%) [17]. This might be explained by the initiative launched to detect and diagnose people with COPD before the COPD study [21]. Another explanation could be that people with AF may visit the health care system less often compared to people with COPD.

In our study, 82% of the study population received anticoagulation medication. This result is in line with a review from 2017 comparing registers from different parts of the world that showed a worldwide increase in the use of oral anticoagulation medication from 67% to > 80% in the last decades among patients with AF. However, regional differences were found, with the lowest uptake in Asia (57%) and the highest in Europe (90%) [45]. Furthermore, the results are similar to those of the study from 2022 [10], where competing reasons for treatment with anticoagulants were included and found to be quite rare among the study population. However, it does not meet the recommendation for 90% of patients undergoing treatment. The need for anticoagulant treatment among patients with AF is usually assessed using the CHA_2DS_2-VASc score, an assessment tool for common risk factors of ischaemic stroke among patients with AF [46]. A score of zero for men and one for women represents a low risk of mortality and ischaemic stroke [46], and not all patients are recommended for treatment because of the risk of severe bleeding. However, only 25 patients (3.5% of the study population) had a CHA_2DS_2-VASc score registered, which was surprisingly low. The CHA_2DS_2-VASc has been used in Greenland for years but is a relatively new assessment tool in the EMR, and data extraction for research requires that the score is registered correctly in a designated table. Therefore, we assume that a higher proportion has had a score registered but it may be listed elsewhere in the journal.

BMI was measured in 47% of our study population within the previous year, which is higher than that among the Greenlandic hypertension population (44%) [17], but lower than that among the Greenlandic COPD population (53%) [21]. Within the previous year, 41% of the study population had their blood pressure measured, which is lower than that of the Greenlandic hypertension population (50%) [17] and the COPD population (53%) [21].

In Denmark, the recommendations state that 80% of patients should have undergone echocardiography between six months prior to and three months after the AF diagnosis [25]. Only 146 patients (21% of the study population) underwent echocardiography in our study. This might be underestimated since data extraction, as earlier mentioned, requires correct registration in the EMR. In Denmark, 77% of the patients with AF had an echocardiography performed within the recommended timeframe [25]. Among the 146 patients who underwent echocardiography in our study, 101 were diagnosed with HF, and it is impossible to determine whether the echocardiography was performed concerning their HF diagnosis or as part of the assessment of AF.

According to the recommendations from Denmark, 95% of patients with AF should have their TSH level measured between 60 days before and 30 days after AF diagnosis, which was measured in 77% of the Danish study population [25]. In our study, 84% of the patients had had their TSH levels measured. Additionally, almost all patients (98%) had their serum creatinine level measured, which is the only indicator of quality of care that meets the Danish guideline recommendation of 90% [25].

Strengths and limitations

This study is the first to describe diagnosed AF in Greenland based on diagnosis codes. Furthermore, the study offers a comprehensive description of risk factors among patients diagnosed with AF and is the first to describe the quality of care among patients diagnosed with AF in Greenland. A strength of this study is the use of data from the Greenlandic EMR, including data on 95% of the Greenlandic population, strengthening the validity of the study findings. The prevalence in our study might be underestimated since patients with AF in Greenland are not necessarily registered with a diagnosis code. However, this may be less important as all records of patients treated with anticoagulation medication have been reviewed and registered with a diagnosis code before this study.

We were unable to extract the exact dates of AF diagnosis or diagnoses of comorbidities, which is a major limitation of this study. Similarly, we could not determine whether echocardiography was performed by indication of AF or HF. The quality of care may be underestimated on several parameters, such as smoking, blood pressure, and BMI, due to incorrect registration in EMR since values will only be extracted if registered correctly in the EMR. Furthermore, CHA_2DS_2-VASc score and echocardiography are often not registered in the lifestyle table in the EMR but reported elsewhere in the journal.

Conclusions

In line with previous studies, we found an increasing prevalence of AF with age and a greater proportion of men than women until the age of 74 years. Well-known risk factors for AF are common in the Greenlandic AF population. However, the requirement of only one out of eight quality indicators of care was met among the patients in our study. To monitor and evaluate the quality of care nationally, correct registration of clinical parameters in the EMR is essential. A lack of knowledge of national guidelines related to the high turnover of healthcare professionals in Greenland may be linked to incorrect registration. There has been an increased focus in Greenland on registering medical diagnosis codes in the EMR for patients with diabetes for more than a decade, and continued monitoring effort has resulted in a stable quality of care [18]. Furthermore, a study from 2022 showed an improved quality of care among people diagnosed with hypertension compared to those who received antihypertensive medication but did not have a diagnosis code in the EMR [17]. These results highlight both the importance of correct registration and that initiatives promoting registration in the EMR are effective. However, easy and intuitive ways to register indicators such as the CHA_2DS_2-VASc scores should be a point of focus.

It is therefore recommended to increase the focus on diagnosis coding, standard record keeping, and continuous monitoring of prevalence and quality of care among AF patients. As with diabetes, meeting the quality indicators for AF should be within reach in Greenland.

Disclosure statement

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

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Data availability statement

The data underlying this article will be shared on reasonable request to the corresponding author.

Authors contributions

MLP and NA conceived the study idea. MTN cleaned and analysed the data in collaboration with MHN. MTN drafted the first version of the manuscript. The final draft of the manuscript was reviewed and approved by all authors. NA supervised the overall project.

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