




# BMJ Open Canada-wide mixed methods analysis evaluating the reasons for inappropriate emergency department presentation in patients with a history of atrial fibrillation: the multicentre AF-ED trial

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## ABSTRACT

**Objectives** The primary objective of this study was to ascertain the reasons for emergency department (ED) attendance among patients with a history of atrial fibrillation (AF).

**Design** Appropriate ED attendance was defined by the requirement for an electrical or chemical cardioversion and/or an attendance resulting in hospitalisation or administration of intravenous medications for ventricular rate control. Quantitative and qualitative responses were recorded and analysed using descriptive statistics and content analysis, respectively. Random effects logistic regression was performed to estimate the OR of inappropriate ED attendance based on clinically relevant patient characteristics.

**Participants** Participants  $\geq 18$  years with a documented history of AF were approached in one of eight centres partaking in the study across Canada (Ontario, Nova Scotia, Alberta and British Columbia).

**Results** Of the 356 patients enrolled ( $67 \pm 13$ , 45% female), the majority (271/356, 76%) had inappropriate reasons for presentation and did not require urgent ED treatment. Approximately 50% of patients (172/356, 48%) were driven to the ED due to symptoms, while the remainder presented on the basis of general fear or anxiety (67/356, 19%) or prior medical advice (117/356, 33%). Random effects logistic regression analysis showed that patients with a history of congestive heart failure were significantly more likely to seek urgent care for appropriate reasons ( $p=0.03$ ). Likewise, symptom-related concerns for ED presentation were significantly less likely to result in inappropriate visitation ( $p=0.02$ ). When patients were surveyed on alternatives to ED care, the highest proportion of responses among both groups was in favour of specialised rapid assessment outpatient clinics (186/356, 52%). Qualitative content analysis confirmed these results.

**Conclusions** Improved education focused on symptom management and alleviating disease-related anxiety as well as the institution of rapid access arrhythmias

## Strengths and limitations of this study

- To our knowledge, this is the largest prospective, multicentre, mixed methods analysis evaluating patient-specific reasons for inappropriate attendance to the emergency department.
- This study combines both quantitative and qualitative data that permit a more complete and synergistic application of data.
- All patients were interviewed using a standardised approach in order to minimise the impact of interobserver variability.
- The use of a survey-based approach to data collection is susceptible to reporting bias.
- This multicentre study was based on voluntary participation from all centres, and all patients who agreed to take part may not represent the entire patient population.

clinics may reduce the need for unnecessary healthcare utilisation in the ED and subsequent hospitalisation.

**Trial registration number** NCT03127085

## INTRODUCTION

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia encountered in clinical practice and is associated with increasing morbidity and mortality.<sup>1–3</sup> Given its increasing prevalence as an age-dependent disease<sup>4,5</sup> as well as associated cardiovascular complications such as stroke and heart failure, the impact of elevated healthcare utilisation incurred from AF-related emergency department (ED) presentation poses a global healthcare burden.<sup>6</sup> This is particularly relevant when higher healthcare utilisation is required for inappropriate ED presentation,

given that only approximately 15% of Canadian patients with primary AF are admitted to hospital.<sup>7</sup>

In the Canadian population, the overall rate of AF-related hospitalisations is estimated to be 583 per 100 000 individuals,<sup>8</sup> equating to more than \$815 million in hospital costs attributable to AF.<sup>9</sup> However, rates of hospital admission have been found to be as high as 40% in Ontario, with notable variability between centres.<sup>10</sup> Given this, guidelines suggest that hospitalisation should be reserved for patients who are either highly symptomatic or haemodynamically unstable<sup>11 12</sup> and that the remainder may receive further medical treatment outside the ED environment.

Despite the fact that a sizeable percentage of patients with an established diagnosis of AF attend the ED with symptoms perceived to be related to their underlying arrhythmia, many of these attendances may not necessarily warrant emergent care. These inappropriate ED visits may be safely reduced through alternative management strategies, resulting in significant reductions in healthcare utilisation and subsequent hospitalisation.

We, therefore, used a patient-oriented approach to assess the reasons for ED attendance in the setting of AF and to determine factors for inappropriate visitation. These results were then used to evaluate patient preferences with regards to treatment strategies that may be implemented as safe and effective alternatives to ED intervention.

## METHODS

### Participant survey

All patients with an established diagnosis of AF who presented to any of the participating eight academic or community EDs across Canada were approached for enrolment into this multicentre study. All index ED visits were patient initiated as a result of symptoms or concerns perceived to be related to their diagnosis of AF. Attendances occur either as a result of self-reporting or following a call to the emergency services. All patients who attend the ED in Canada are reviewed and triaged by a nurse and a medical doctor, and further management is based on their plan. Patients were not invited to take part if they had other significant comorbidities that resulted in their ED attendance.

Patients were provided with a written invitation and consent form, and only those who completed this following their admission to the ED and mailed it to the recruitment centre were called. All participants received a telephone interview from designated and suitably trained research personnel within 4 weeks of their index visit. Eligibility criteria included: (1) age  $\geq 18$  years, (2) AF being the primary reason for the ED visit, (3) patients with an established history of AF (prior diagnosis documented on ECG or Holter strip) and (4) the ability to provide fully informed consent prior to the telephone interview. Patients were excluded if they were: (1) unable or unwilling to consent and participate, (2)

enrolled in a concurrent cardiovascular drug or device research study and/or (3) had new-onset AF and/or (4) AF secondary to another condition that required active treatment.

Baseline demographic data including age, gender, AF type, existing comorbidities and medications were obtained from patient medical records. Information regarding their condition (symptoms associated with AF, frequency of episodes, severity of symptoms, occurrence of palpitations, shortness of breath, exercise intolerance, lightheadedness and chest pain) and functional activity were obtained through a preformulated survey via telephone. Participants also provided explanations with regards to their reasons for ED attendance, acute interventions received in the ED and final disposition (hospital admission or ED discharge).

### Qualitative discussions

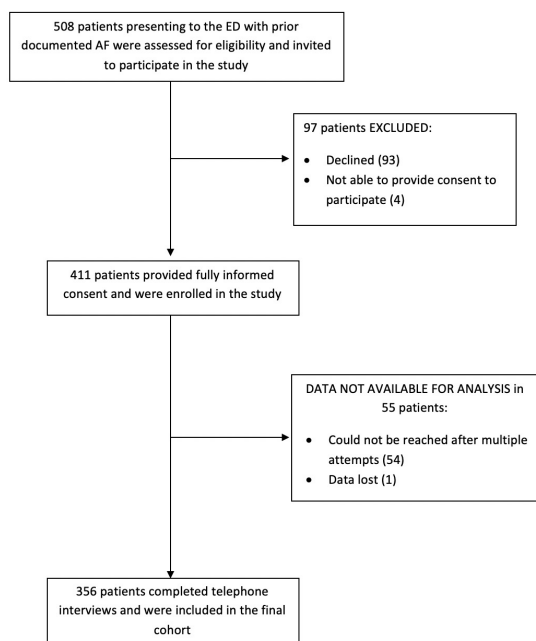
Qualitative responses were recorded in order to further ascertain factors associated within appropriate ED visitation and alternative strategies that could be implemented to assist in the management of their AF. Individual responses to open-ended questions were analysed using a qualitative content analysis approach. Each statement was read in its entirety and coded word for word. Similar coded statements were then grouped together into categories and finally themes.

### Patient and public involvement

The research questions and survey design was developed in collaboration with patient advisers as part of the Cardiac Arrhythmia Network of Canada. Engaging knowledge users at critical stages of the study ensured that key outcome measures would be relevant in guiding future clinical practice for AF and in the management of other chronic conditions.

### Statistical analysis

Quantitative and qualitative responses were recorded and analysed using descriptive statistics and content analysis, respectively. With respect to quantitative analyses, continuous data were analysed using SAS V.9.4. Continuous variables were expressed as mean $\pm$ SD and analysed using Student's t-test or non-parametrical tests (Wilcoxon and Mann-Whitney), as appropriate. Categorical variables were compared using the  $\chi^2$  test, or Fisher's exact test, as appropriate. A two-tailed p value was used in all analyses, and a p value  $< 0.05$  was considered statistically significant. Due to incomplete answers, missing variables and multiple answering options, observed numbers and percentages did not always add up to exactly 100%. Random effects logistic regression was also performed to identify clinical characteristics associated with inappropriate ED attendance (outcome), with participating centres selected as the random intercepts. Logistic regression analysis was performed using SAS V.9.4, with the proc glimmix procedure for modelling.



**Figure 1** CONSORT diagram showing participant flow and final cohort. AF, atrial fibrillation; CONSORT, Consolidated Standards of Reporting Trials; ED, emergency department.

## Definitions

AF type was defined as paroxysmal or persistent according to the recommendations of the 2016 European Society of Cardiology (ESC) Guidelines.<sup>13</sup> Appropriate ED attendance was defined by the requirement for an electrical or chemical cardioversion and/or an attendance resulting in hospitalisation. Cardioversions were deemed appropriate if the patient had AF with haemodynamic instability in the form of angina pectoris, myocardial infarction and shock or pulmonary oedema. Electrical or chemical cardioversions performed for alternate reasons, as per the discretion of the physician, were not considered appropriate reasons for attendance.

## RESULTS

### Survey

Between August 2016 and August 2018, a total of 508 participants were approached to take part in this study. Of these, 97 patients were excluded (declined to participate/unable to provide fully informed consent), and data were unavailable for analysis in 55 patients (figure 1). The final cohort consisted of 356 patients (mean age  $67 \pm 13$ , 45% female) were enrolled across eight centres in four provinces (Ontario, Nova Scotia, Alberta and British Columbia) of which 172/356 (48%) had symptomatic episodes. The majority of patients who were recruited to the study had attended an ED in an academic institution versus an ED based in a community hospital (81% academic vs 19% community).

## Baseline patient characteristics

Baseline characteristics, classification of AF, medication use and existing cardiovascular comorbidities at ED presentation are displayed in table 1. Within this cohort, patients were stratified by appropriateness of their ED visit, of which 85/356 (24%) had indications warranting emergency treatment, while the majority of patients (271/356, 76%) presented for inappropriate reasons that may have been more effectively managed outside the ED setting. Within the appropriate group, 41/356 (12%) underwent chemical cardioversion only, 16/356 (5%) underwent an electrical cardioversion following an unsuccessful attempt at chemical cardioversion, 12/356 (3%) and 16/356 (4%) resulted in an admission into hospital for further management.

After performing logistic regression, the only baseline predictors of an appropriate ED attendance were as follows:

A history of diagnosed congestive heart failure (CHF) (18% vs 7%,  $p=0.007$ ).

A history of vascular disease (myocardial infarction with peripheral arterial disease) (16% vs 9%,  $p=0.04$ ).

Treatment with warfarin (20% vs 10%,  $p=0.03$ ).

The type of AF, AF duration (from time of diagnosis), age and gender did not influence the appropriateness of ED visitation.

The proportion of patients receiving medical therapy at the time of their ED attendance is also displayed in table 1. On ED presentation, more than half of patients were receiving treatment with an oral anticoagulant (OAC) (211/356, 59%). Of these, a significantly higher proportion of patients with appropriate ED visits (17/85, 20%) were receiving warfarin at presentation as compared with those with inappropriate visits (28/271, 10%) ( $p=0.03$ ).

## Reasons for ED visitation and outcomes

Approximately 50% of patients (172/356, 48%) were driven to the ED on the basis of symptoms. All other patients presented for reasons unrelated to their symptoms, namely on the basis of general fear or anxiety (67/356, 19%) or prior medical advice (117/356, 33%).

When presenting concerns were compared on the basis of visit appropriateness, the majority of patients receiving appropriate ED treatment did so on the basis of their AF-related symptoms (71/85, 84%) while only 101/271 (37%) of those in the inappropriate group presented on the basis of symptoms. As shown in figure 2, AF symptom reporting was found to be significantly correlated with appropriate ED attendance ( $p<0.0001$ ). The most commonly reported symptom prompting patients to attend the ED, irrespective of visit appropriateness, were palpitations (58/71, 82%) followed by shortness of breath (22/71, 31%), chest tightness (18/71, 25%) and dizziness or lightheadedness (14/71, 20%). A note should be made that patients could report more than one symptom explaining why the percentage is greater than 100%. Each of these symptoms was statistically more significant

**Table 1** Baseline demographics of the patient cohort presenting to the ED for AF-related reasons, stratified by appropriateness of visit

	All patients n=356	Assessed as appropriate n=85	Assessed as inappropriate n=271	P value
Age (mean±SD)	67±13	67±14	67±13	NS
Female (n (%))	160 (45)	40 (47)	120 (44)	NS
Duration of AF from time of initial diagnosis in months (mean±SD)	14 (±9)	15 (±10)	14 (±9)	NS
Type of AF (n (%))				
Paroxysmal	245 (69)	56 (66)	189 (70)	NS
Persistent	40 (11)	11 (13)	29 (11)	NS
Permanent	71 (20)	18 (21)	53 (19)	NS
Comorbidities (n (%))				
CHF	34 (10)	15 (18)	19 (7)	p=0.007
HTN	164 (46)	41 (48)	123 (45)	NS
DM	38 (11)	10 (12)	28 (10)	NS
Stroke/TIA	35 (10)	10 (12)	25 (9)	NS
MIPADAP	37 (10)	14 (16)	23 (9)	p=0.04
CHADS <sub>2</sub> -VASc score (n (%))				
0	56 (16)	10 (12)	46 (17)	NS
1	54 (15)	18 (21)	36 (13)	NS
≥2	242 (68)	55 (65)	187 (69)	NS
Medications (n (%))				
CC-blocker	72 (20)	17 (20)	55 (20.3)	NS
β-blocker	170 (48)	40 (47)	130 (48)	NS
ARB	26 (7)	8 (9)	18 (6.6)	NS
ACE-I	47 (13)	11 (13)	36 (13)	NS
AAD	90 (25)	26 (31)	64 (24)	NS
ASA	68 (19)	21 (25)	47 (17)	NS
DOAC	166 (46)	38 (45)	128 (48)	NS
Warfarin	45 (13)	17 (20)	28 (10)	p=0.03
OAC	211 (59)	55 (65)	156 (58)	NS
Duration of AF before ED visit in minutes (n, mean±SD)	717.1±332	773.7±301	699.2±340	NS
Thirty-day symptoms (n (%))*				
Yes	241 (68)	62 (73)	179 (66)	NS
No	114 (32)	23 (27)	91 (34)	NS
Previous ED Visits (n (%))				
0	31 (9)	10 (12)	21 (8)	NS
1	82 (23)	17 (20)	65 (24)	NS
2	61 (17)	11 (13)	50 (19)	NS
3	47 (13)	15 (18)	32 (12)	NS
4	22 (6)	4 (5)	18 (7)	NS
5	111 (31)	28 (33)	83 (31)	NS

Continued

Table 1 Continued

	All patients n=356	Assessed as appropriate n=85	Assessed as inappropriate n=271	P value
ED visit every AF episode (n (%))				
Yes	94 (27)	24 (28)	70 (26)	NS
No	149 (42)	34 (40)	115 (42)	NS

\*Symptoms with the 30 days preceding ED attendance related to AF.

AAD, antiarrhythmic drug; ACE-I, angiotensin-converting-enzyme inhibitor; AF, atrial fibrillation; ARB, Angiotensin II receptor blocker; ASA, aspirin; CC-blocker, calcium-channel blocker; CHF, congestive heart failure; DM, diabetes mellitus; DOAC, direct oral anticoagulant; ED, emergency department; HTN, hypertension; MIPADAP, myocardial infarction with peripheral arterial disease; OAC, oral anticoagulant; TIA, transient ischaemic attack.

in the appropriate than inappropriate group ( $p < 0.0001$  for each symptom).

Conversely, inappropriate ED attendance was significantly correlated to patients receiving medical advice prior to their ED visit (113/271, 42%;  $p < 0.0001$ ).

Notably, significantly more patients who presented for inappropriate reasons were driven by prior medical advice related to the duration of their AF episodes (18% vs 1%,  $p < 0.0001$ ) or heart rate (21% vs 6%,  $p = 0.002$ ) as compared with those with appropriate visits. Among patients who were fearful of experiencing further complications, such as stroke, the mean CHADS<sub>2</sub>-VASc score was 2 and more than 50% of patients (37/67, 55%) were receiving treatment with an OAC at baseline presentation.

Education level and annual income category did not impact the appropriateness of the patient's visit to the ED.

A random effects logistic regression model was then conducted to identify which baseline characteristics and presenting patient concerns were significantly associated with inappropriate ED attendance (table 2). This included clinically relevant covariates such as age, sex and anticoagulation status. The model suggested that having an existing history of CHF or attending the ED on the basis of symptoms was significantly associated with a decreased odds of inappropriate ED attendance with an

OR=0.3 (95% CI 0.111 to 0.864,  $p = 0.025$ ) and an OR=0.1 (95% CI 0.00784 to 0.590,  $p = 0.015$ ), respectively; that is, the attendance was deemed to be more appropriate. No other variables were found to be significantly associated with inappropriate ED attendance in this analysis.

#### Alternatives to ED management

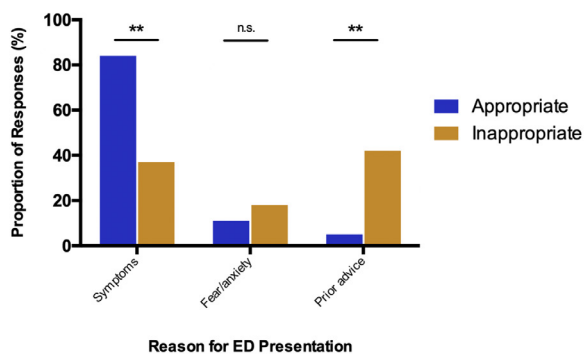
Overall, 24% (85/356) of patients considered their ED attendance absolutely necessary, of which only 22/85 (26%) presented for reasons warranting treatment in the ED. Of the 271/356 (76%) who felt that their attendance was not necessary 63/271 (23%) had an attendance that was deemed to be significant. When patients were surveyed regarding potential alternatives to seeking emergency care, the highest proportion of responses among both groups were in favour of an accessible rapid assessment outpatient arrhythmia clinic (186/356, 52%). The proportion of patient responses for other alternatives including an arrhythmia telephone service, accessibility to an arrhythmia nurse and an AF smart phone application was comparable between the two groups (table 3).

#### Qualitative results

##### Impact of AF on general health

The impact of AF on general health status was summarised by most participants mentioning how their daily activities had become limited. Recreational activities such as exercising at the gym, golfing, running, hiking or curling had subsequently decreased or stopped. Some participants also mentioned that their work performance had been adversely affected. In describing living with AF, participants described a markedly decreased quality of life, as much as 'a 3 or 2/10' and expressed concerns of maintaining relationships with others (figure 3).

Participants also mentioned frequently experiencing physical symptoms such as chest pain, chest tightness and shortness of breath during episodes of AF. Experiencing these symptoms was described by many as reasons for attending the ED. Further discussions revealed that panic and anxiety were commonly encountered due to their AF, while several patients expressed their constant fear of having a 'heart attack'. Finally, participants commented



**Figure 2** Proportion of survey responses of patient-specific reasons for seeking urgent care; \*\* $p < 0.0001$ . ED, emergency department.

**Table 2** Random intercepts logistic regression analysis for the prediction of inappropriate ED attendance

Covariate	Estimate	SE	df	t-ratio	P value	OR	95% CI lower limit	95% CI upper limit
Sex	0.009916	0.3989	224	0.02	0.9802	10 100	0.4602	2.2166
Age	0.01659	0.02012	224	0.82	0.4104	1.0167	0.9772	1.0578
CHF	-1.1725	0.5210	224	-2.25	0.0254*	0.3096	0.1109	0.8643
CHA <sub>2</sub> DS <sub>2</sub> -VAsC score	0.05266	0.3655	224	0.14	0.8856	1.0541	0.5129	2.1661
Warfarin	-0.7404	0.5062	224	-1.46	0.1448	0.4768	0.1758	1.2929
ED every AF episode	-0.4922	0.3582	224	-1.37	0.1708	0.6113	0.3018	1.2382
Number of prior ED visits	-0.1615	0.1169	224	-1.38	0.1684	0.8508	0.6757	1.0713
Main reason symptoms	-2.6879	1.0965	224	-2.45	0.0150*	0.06803	0.007839	0.5903
Main reason fear/anxiety	-1.4254	1.1700	224	-1.22	0.2244	0.2404	0.02397	2.4114
Advice healthcare	0.7571	0.9811	224	0.77	0.4411	2.1321	0.3085	14.7371

\*Denotes significance  $p < 0.05$ .

.AF, atrial fibrillation; CHF, congestive heart failure; ED, emergency department.

on making lifestyle changes to accommodate life with AF. They mentioned a variety of physical activities such as walking short distances and engaging in low-impact aerobics, yoga and staying active. Select patient quotes are shown in [figure 3](#).

#### Reasons for ED visitation and outcomes

Participants described the factors contributing to their decision to attend the ED. As displayed in [figure 3](#), these factors focused largely on their physical symptoms, emotional response, duration of symptoms and prior advice. The majority of participants mentioned experiencing symptoms such as rapid, racing and irregular heart rates, while others recalled feelings of lightheadedness and nausea, or experiencing numbness or swelling in the extremities. For many patients, these physical symptoms came suddenly, with many concerned that they '*would have a heart attack, stroke or complications (clots)*'. In addition to AF-related symptoms, many participants reported having overall unpleasant or 'funny feelings' and stated that they intuitively could sense '*something was wrong*'.

With respect to emotional responses, many participants recalled feeling scared particularly when these symptoms did not resolve on their own with rest or medications. Fear of dying was consistently mentioned as well as fear of experiencing AF-related complications. Further

discussions led to patients explaining that '*The horror of it [experiencing complications] is horrible*'. A sizeable portion of participants stated that they had experienced symptoms for more than 1 day prior to coming to the ED, which they attempted to manage on their own but were eventually unsuccessful.

A significant number of participants also mentioned being advised to go to the ER by their physician or another health provider (pharmacist, paramedic and clinic staff) after describing their symptoms and their duration.

#### DISCUSSION

To our knowledge, this is the largest prospective, multi-centre, mixed methods analysis evaluating patient-specific reasons for inappropriate attendance to the ED based on quantitative and qualitative data.

In order to understand factors associated within appropriate ED attendance, we quantitatively and qualitatively reviewed patient characteristics. The principal findings of this study are that more than 75% of patients presenting to the ED with a history of AF did not receive treatment warranting urgent ED care. Factors influencing the inappropriateness of ED visitation included patient decisions based on prior advice prescribed by a healthcare

**Table 3** Proportion of patient responses favouring alternative management strategies, stratified by inappropriate versus appropriate visits

Alternative strategy	Appropriate n=85 (n (%))	Inappropriate n=271 (n (%))	P value
Arrhythmia telephone line	30 (35)	87 (32)	0.68
24/7 arrhythmia nurse	26 (31)	86 (32)	0.95
Rapid assessment outpatient clinic	48 (57)	138 (51)	0.44
AF smartphone application	3 (4)	16 (6)	0.57
No alternative to ED	22 (26)	63 (23)	0.73

AF, atrial fibrillation; ED, emergency department.

## GENERAL HEALTH DISCUSSIONS

## Living with AF

- "When I am in AF walking 10 feet feels like I am running a mile. Dizzy spells; short of breath; worried. Even when I am not in AF I am worried. It comes suddenly, without warning. This has effected my way of life, my confidence, I can't travel"
- "Everything is planned around AF."

## Quality of Life

- "It has ruined my life. I was a human being before this started."
- "Quality of life is a 3 or 2/10. I can't do much of anything. I sit here in a cold sweat and don't do much of anything"

## Physical and Emotional Responses

- "If I am in AF I have no stamina. It is all I can do to get out of bed."
- "[I am] "scared of doing anything" physical"

## Self-management Strategies

- "I have had to work around it. It doesn't stop me from doing what I want to do. I hike and kayak."
- "Another person remarked trying to enjoy life if not experiencing AF"

## REASONS FOR ATTENDING THE ED

## Physical Symptoms

- "I felt like my heart was going to jump out of my chest"
- "I was afraid I would have a heart attack.", stroke or complications (clots)"
- "You just know, you really know. You get a funny feeling. You know it's coming."
- "My heart would race and beat irregularly. I would feel very fatigued, dizzy, and short of breath. I know that I needed to go to the ED."

## Emotional Response

- "The horror of it is horrible."
- "I felt that there was something seriously wrong with me."

## Duration of Symptoms

- "Heaviness in my chest. Usually I can just sit and sip water and take deep breaths and it will stop by itself. When it gets very heavy, I go to ED and heart racing."
- "[I want to] have quality of life back"

**Figure 3** Select patient quotes. AF, atrial fibrillation; ED, emergency department.

professional. In the random effects logistic regression, only two factors appeared to be significantly associated with a decreased odds of inappropriate ED attendance, including an existing history of CHF and patient concerns derived on the basis of AF-related symptoms. Qualitative analysis confirmed these results as physical symptoms, emotional response and prior advice were cited as the predominant reasons for ED visitation. Overall, a marginal proportion (<25%) of patients deemed their ED attendance to be absolutely necessary and responded favourably towards alternative treatment strategies, including a rapid assessment outpatient clinic, access to a nurse practitioner and a smartphone application. The highest proportion of responses among both groups was in favour of a specialised rapid assessment outpatient clinic. The results of the current study suggest that many patients may be more effectively managed outside of the ED without compromising the quality or delivery of care and thereby, reducing annual healthcare costs associated with AF-related ED attendances and inappropriate hospitalisations.

AF-related hospitalisations have increased <2.4fold from 1985 to 1999 and by an additional 23% in the past decade, contributing to the elevated costs incurred from AF management over the years.<sup>14</sup> Insight into patient perspectives for attending the ED with an existing history of AF therefore have the potential to inform

the development of management pathways to promote effective self-management and avoid inappropriate ED attendances altogether. Previous studies have highlighted discrepancies in structured AF management with respect to bridging the gap between ED expertise and integrated AF care in an outpatient setting. Of these, results demonstrated that a significant proportion of ED patients are appropriate for safe and effective outpatient management of AF.<sup>15–17</sup> These pathways include strategies for early rhythm control, initiation of rate control therapies and anticoagulation for stroke prophylaxis.<sup>15 16</sup> However, due to barriers in implementation, these strategies have yet to be maintained nor fully accepted. The current results provide evidence for the initiation of rapid assessment outpatient clinics that provide specialised care for AF symptom management. In a recent meta-analysis, nurse-led AF clinics were found to be more cost-effective, have shorter wait times and reduce subsequent ED visits and hospitalisations.<sup>17</sup> When compared with standard care, guideline-based medication adherence and patient mortality rates were lower, while quality of life was improved. However, in a study randomising patients with a history of AF to receive nurse-led care or usual care, there was no overall advantage to nurse-led care in a composite of cardiovascular death and cardiovascular hospital admissions.<sup>18</sup>

The current study also reveals a considerable proportion of patients who present to the ED in the absence of symptoms and instead driven predominantly on the basis of generalised fear or prior medical advice. Subsequent content analysis highlighted that patient decisions were driven, largely in part, by their emotional response to their AF episode as well as the lack of self-management strategies that currently exist. Therefore, it is of critical importance to also tailor AF management strategies towards improving out-of-hospital patient education and providing readily accessible resources. If patients perceive to have rapid access to tools and resources that can guide their acute decision making, they may be less likely to visit the ED altogether.

Of note despite the fact that 68% of patients had a CHA<sub>2</sub>DS<sub>2</sub>-VASc, score of 2 or more, only 59% of patients were receiving oral anticoagulation in the form of either a direct OAC or warfarin. Additionally, only half of all patients who attended the ED due to a fear a potential stroke were receiving an OAC despite a mean CHA<sub>2</sub>DS<sub>2</sub>-VASc score of 2. While some of these patients may have not met the criteria for an OAC and some may have had a potential risk of bleeding, there still remains a treatment gap that should be addressed in the initiation of OACs in patients who are considered at a significant risk of stroke, and this may have a positive impact on a reduction in the numbers of patients who attend due to a risk of stroke.

Patients also selected the use of smartphone technology as a viable alternative to usual ED management. Due to the increasing demand for technology in healthcare practices, the ESC, in collaboration with the CATCH ME consortium, has developed smartphone and tablet apps



for patients and healthcare professionals<sup>19</sup> as part of the 2016 AF Guidelines. Indeed, the feasibility of mobile technology and remote telephone services has been explored and shown to be associated with increasing efficacy over the years. Previously, the use of telemedicine for rapid out-of-hospital diagnosis and the provision of objective instructions has been assessed as an alternative management pathway for patients with a history of paroxysmal AF.<sup>20</sup> Results of this study demonstrated that almost 80% of paroxysmal AF episodes were managed successfully out of hospital, avoiding the need for unnecessary hospitalisations or clinic visits.

Taken together, future studies should examine novel protocols for outpatient management that involve the integration of technology to enhance the institution of multidisciplinary nurse-led AF assessment clinics and the delivery of patient-centred care.

### Limitations

There are several limitations that should be considered when interpreting the current results and that may be better addressed in future studies. First, the use of a survey-based approach to data collection is susceptible to reporting bias. However, integration of a mixed methods approach permits a more complete and synergistic application of data than quantitative and qualitative data analyses alone. Second, this multicentre study was based on voluntary participation from all centres. Yet, while we sought to achieve geographic variability through an equal distribution of participating centres across provinces, the resulting cohort tended to favour patients attending an academic centre (81% academic vs 19% community). It should also be highlighted that only medium to high expertise centres were approached and eventually enrolled.

The designation of appropriate ED attendance is based on the need for a cardioversion (either electrical or chemical) or an admission to the hospital. While this is based on current guidelines, it could be argued that patients with AF and an elevated ventricular rate may be considered as an appropriate attendance as they may require treatment with intravenous rate control agents and monitoring. These data are not available for analysis, and this should be considered a limitation of the study.

Only participants who returned a completed consent form following their discharge from the ED were approached to take part in this study. Additionally, 19% of patients who were approached for this study declined to take part, which may have altered the distribution of responses. While the recruitment of patients was difficult at times based on institution-specific approaches to accessing and documenting ED data, each centre had high response rates that avoided the need for multiple sampling over time. The AF-ED multicentre trial still remains the largest Canadian multicentre mixed methods assessment of patient-specific motivators for ED attendance in those with a history of AF. Therefore, while several noteworthy conclusions can be drawn from these

results, future studies should focus on devising novel out-of-hospital protocol for integrated AF management and self-management techniques focused on both symptom reduction and improving emotional well-being.

### CONCLUSIONS

Given the epidemic proportions of AF incidence and prevalence predicted for the coming decades, outpatient rapid assessment pathways and improved patient education may provide optimal treatment alternatives for AF, thereby reducing the need for consuming valuable and limited healthcare resources in the ED.

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