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## Existential aspects in the transition to parenthood based on interviews and a theatre workshop

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# Cost Analysis of a Dedicated Outpatient Clinic in Patients With Newly Diagnosed Atrial Fibrillation

Lars Thysoee, PhD, MLP, RN; Kristian Kidholm, PhD; Maja Kjær Rasmussen, MSc; Axel Brandes, PhD

**Aims:** The aim of this study was to assess healthcare utilization costs of a dedicated outpatient clinic for patients with atrial fibrillation (AF). **Methods:** We conducted a registry-based retrospective study in patients with a first-time AF diagnosis from 2009 to 2011 (control group) and 2013 to 2015 (intervention group). The control group had physician-led usual care, and the intervention group received multidisciplinary care. The primary outcome was total costs of AF-related resource utilization. Exploratory outcomes were ischemic stroke, intracranial hemorrhage, and all-cause mortality. Multiple regression methods were used to control for confounders in the assessment of effects on outcomes. **Results:** A total of 1552 patients were included, hereof 850 in the intervention group. Total AF-related costs were €2746 for the control group and €3154 for the intervention group, which was not statistically significant. Average outpatient costs were significantly higher in the control group than in the intervention group (€522 vs €344, respectively;  $P = .003$ ). There was no difference in the number of AF-related hospital admissions and outpatient visits between the control group and the intervention group (incidence risk ratio, 1.03 vs 0.85; and 95% confidence interval, 0.92–1.16 vs 0.69–1.05, respectively). There was a trend toward reduced all-cause mortality (hazard ratio, 0.86; 95% confidence interval, 0.63–1.16) in the intervention group, which was not statistically significant. **Conclusion:** Total expenses for AF-related hospital resource utilization in the intervention group were higher, but the expenses for AF-related outpatient visits were significantly lower. There was a trend toward lower all-cause mortality in the intervention group, although the differences were not statistically significant. More research is needed investigating whether a multidisciplinary AF clinic is cost-effective.

**KEY WORDS:** ambulatory care, atrial fibrillation, cost analysis, nurse specialists

Atrial fibrillation (AF) is the most common dysrhythmia and is associated with increased morbidity and mortality.<sup>1</sup> Studies have shown that the main cost driver is hospitalization.<sup>2</sup> Interventions that can reduce admissions in patients with AF are also important because hospitalizations are associated with increased symptom burden and severity as well as reduced health-related quality of life.<sup>3</sup>

One approach is an outpatient clinic for elective treatment and short-term follow-up.<sup>4</sup> Atrial fibrillation care coordinators in outpatient settings have been found to decrease waiting times and the number of appointments, improve patient experiences of dysrhythmia services, and cut healthcare costs.<sup>5</sup> This effect was also shown in a randomized study comparing a nurse-led AF clinic with

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## Author Contributions:

L.T. (a nurse researcher) and A.B. (a heart rhythm specialist) conceived the overall idea for the study. All authors designed the study. L.T. and

M.K.R. (health economists) performed the statistical analyses, and all authors (L.T., A.B., M.K.R., and K.K. [health economists]) did the interpretation of data. L.T. and M.K.R. wrote the first draft of the manuscript. All authors revised the manuscript critically. All authors have given their final approval of the version to be published.

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usual outpatient care. In this study, the nurse-led AF clinic care turned out to be cost-effective, to improve patient management, and to reduce hospitalizations and death.<sup>6</sup> The same positive effect was shown in a systematic mixed review of cost-effectiveness analyses of nurse-led AF clinics.<sup>7</sup>

Data on the economic effect of an outpatient clinic for patients with AF with a multidisciplinary approach, where physicians and nurses work closely together and collaboratively set treatment goals for the patient,<sup>8</sup> are scarce. On the basis of the existing literature, our hypothesis was that, in the organizational setting, we would expect that a dedicated outpatient clinic with a multidisciplinary team can optimize outpatient treatment for patients with AF and can reduce AF-related healthcare costs within the hospital.

Therefore, the aim of our study was to assess the effect on total cost of AF-related resource utilization of a dedicated outpatient clinic using a multidisciplinary approach for patients with AF. To ensure that quality of care was not compromised, explanatory outcomes were the incidence of ischemic stroke, intracranial hemorrhage, and total mortality.

## METHODS

This study was a retrospective single-center control intervention study comparing 2 groups of patients with AF managed before and after the establishment of a specific AF outpatient clinic.

All residents of Denmark are, at birth or immigration, issued a permanent unique civil registration number that enables individual-level linkage between administrative registries.<sup>9</sup> The Danish National Patient Register holds information on all hospital visits of both inpatient admissions and outpatient visits.<sup>10</sup> Each hospitalization discharge is coded with 1 primary and 1 or more secondary diagnosis codes according to the *International Classification of Diseases* and Nordic procedure codes as appropriate. The Odense Pharmacoepidemiological Database holds data on all prescriptions redeemed by patients from the region of Southern Denmark and was used to identify drug use at baseline.<sup>11</sup>

### Setting

This study took place in an outpatient clinic at a university hospital in Denmark. The AF clinic was established in February 2012, and before this, patients with AF were seen in the ordinary outpatient clinic by a physician (not an AF specialist), where nurses were not involved in the consultations. Thus, the setup depicts a situation of an operating outpatient clinic, which has been optimized during implementation.

### Study Groups and Follow-up

The study was carried out by comparison of outcomes for patients with a first-time diagnosis of AF (*International*

*Classification of Diseases, Tenth Revision [ICD-10]* codes I480, I481, I482, and I489) before the AF clinic was established, with a group of patients given a diagnosis of AF after the AF clinic was established. We included patients with a first-time diagnosis of AF to make the 2 groups as homogeneous as possible. Patients with known AF would have different needs depending on the duration of their AF history and previous treatments. The codes used to identify study participants from the registry data ensured that they had not previously had an AF diagnosis.<sup>10</sup>

### Control Group

Patients with a first-time diagnosis of AF between 2009 and 2011 (January 1, 2009, to January 1, 2011) were included in the control group. They had an initial outpatient appointment of 30 minutes in duration with a physician at the cardiology outpatient department. There was no in-advance strategy for how often patients were seen for a follow-up visit by a physician, who was not necessarily a heart rhythm specialist. Patients with several appointments at the outpatient clinic over time could meet different physicians at each appointment.<sup>12</sup> Nurses did not have consultations with patients at all.

### Intervention Group

Patients with a first-time diagnosis of AF between 2013 and 2015 (January 1, 2013, to January 1, 2015) were included in the intervention group. Because the AF clinic has been established in 2012, all patients with AF had a structured consultation course with a multidisciplinary team, which consisted of a heart rhythm specialist and several AF nurse specialists with years of experience and a special interest in AF. The initial appointment was with the heart rhythm specialist. At this appointment, a medical history was taken, and a complete physical examination as well as a 12-lead electrocardiogram (ECG) and an echocardiography were performed. After the examinations, the patients were informed about their results. Then, the heart rhythm specialist provided information about AF tailored to the individual patient. An individual treatment plan was developed and discussed together with the patient and then initiated. The follow-up visits were with an AF nurse specialist, the first time usually after 3 months. The nurse recorded the medical history since the last visit, assessed pulse and blood pressure, and obtained a 12-lead electrocardiogram. Blood samples were taken as needed. The nurse explained medications and changes in medical treatment, if necessary, in close collaboration with the heart rhythm specialist. Moreover, the nurse focused on following up on the information given by the heart rhythm specialist and ensured that the patients understood and was able to handle their situation. Difficult cases were discussed on an ad-hoc basis between the AF nurse specialists and

the heart rhythm specialist. The nurse coordinated the following consultations and decided for how long the patient would be followed in the AF clinic and when patients could be discharged to further follow-up by their general practitioner. Each consultation was approximately 30 to 40 minutes in length, including medical history and electrocardiogram at each consultation. The heart rhythm specialist and the nurse also discussed selected patient cases at regular multidisciplinary team conferences. Furthermore, the nurse involved the heart rhythm specialist, if necessary, while the patients were present during the consultation, and the nurse provided the telephone number for the AF clinic, in case the patient had any questions after the consultation.

The sample size was determined by number of eligible patients within these periods (Figure 1).

In general, Danish hospital outpatient visits are coded with good precision in the hospital electronic health record system,<sup>13</sup> as financing was based on activity in terms of outpatient visits and admissions. Patients were systematically referred to the AF clinic when first given a diagnosis of AF, hence there is good reason to trust the registration of visits.

### Comorbidities

The following comorbidities were identified using *ICD-10* codes: stroke, heart failure, ischemic heart disease, chronic obstructive pulmonary disease, chronic kidney disease, liver disease, and vascular disease. The comorbidities were chosen based on clinical expertise and used for the adjusted regression analysis.

Claimed drug prescriptions were used to identify hyperthyroidism, hypertension, and diabetes. Furthermore, use of non-vitamin K antagonist oral anticoagulants, warfarin, and platelet inhibitors were identified at baseline. Nordic procedure codes were used to determine whether patients had received a pacemaker or an implantable cardioverter-defibrillator.

### Study Outcomes

The primary outcome was total cost of AF-related hospital resource utilization. Ischemic stroke, intracranial hemorrhage, and all-cause mortality at 12 months were explanatory outcomes.

### Measurement of Study Outcomes

Resource use was derived from the Danish National Patient Register, reported as healthcare utilization per patient in terms of outpatient visits, admissions, unplanned visits, and total AF-related/heart-related hospital costs.

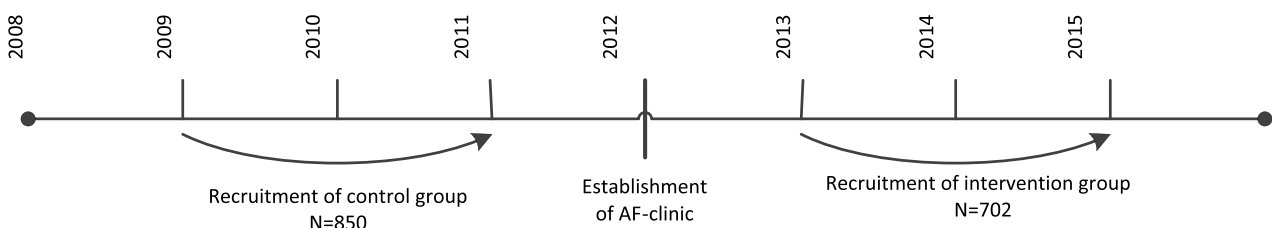
As the intervention consisted of organizational changes in routine practice of outpatient care, intervention costs were included in the average cost per patient of outpatient visits during the follow-up period. Cost categories were AF-related costs of outpatient visits, admissions, unplanned visits, and total AF-related hospital costs. Similar categories were applied on heart-related hospital resource utilization and costs of outpatient visits, admissions, unplanned visits, and total heart-related hospital costs. All prices were defined by Diagnostic Related Group rates, which are national tariffs for reimbursement of hospitals.<sup>10</sup>

Resource use and cost variables were handled in the analysis according to guidelines for conducting health economic analyses.<sup>14</sup> Costs were adjusted to 2016 prices by use of regional Danish price and wage indices.<sup>15</sup>

Clinical outcomes were derived from the Danish National Patient Register and Danish Civil Registration number Register, and defined as the number of patients (and percentage) experiencing an outcome within the follow-up period of 1 year. Mortality was measured as all-cause deaths and was derived from the Danish Civil Registration number register. Events of ischemic stroke and brain hemorrhage were derived from the Danish National Patient Register by *ICD-10* codes of each event.

### Statistics

Categorical variables are presented as percentages and were analyzed using  $\chi^2$  test. Continuous variables are presented as mean (SD), and Student *t* test was used to test for differences between groups. A multiple regression analysis was performed to analyze differences in effects on costs and healthcare utilization. To limit the effects of a potentially different number of patients in the groups, results were reported as percentages for clinical outcomes and in averages for costs. The main analysis, on total costs of AF-related resource utilization, was controlled for confounding factors as age at baseline, gender, and comorbidities at baseline (hypertension, ventricular dysrhythmia, ischemic heart disease,



**FIGURE 1.** Period of recruitment.

myocardial infarction, hypercholesterolemia, renal disease, heart failure, diabetes, chronic obstructive pulmonary disease).

Analyses on effects were divided into 3 categories. First, generalized linear model (GLM) (gamma, identity link) regression was suitable for analysis of cost data as the distribution of cost data is highly skewed and contains natural zeros.<sup>16</sup> Second, quasi-Poisson regression, which is suitable when data are a count and overdispersed, was used for modeling resource use.<sup>17</sup> Finally, Cox regression, which is suitable for analyzing time-to-event data, was used for survival analysis.<sup>18</sup> For graphical representation, we used Kaplan-Meier estimates to depict all-cause mortality. A 2-sided *P* value less than .05 was considered statistically significant. Statistical analyses were performed using R software version 3.5.2 (R Development Core Team [2008], R Foundation for Statistical Computing, Vienna, Austria; <http://www.R-project.org>).

### Ethical Approval

In Denmark, register studies do not require formal approval from the ethics committees according to legislation. The study was approved by the management of the Department of Cardiology, which was notified by the Danish Data Protection (reference no. 2008-58-0035), and data were available in an anonymized format so that specific individuals could not be identified.

## RESULTS

The registry-based study sample of patients given a diagnosis of AF at initial diagnosis appears in the flowchart (Figure 2). After excluding 63 patients who did not have a registration of AF diagnosis within the exact inclusion dates, 1552 patients remained in the analysis: 702 patients in the control group and 850 patients in the intervention group.

### Baseline Characteristics

The baseline characteristics are shown in Table 1.

Patients in the control group were significantly younger at baseline (mean [SD] age, 66.89 [14.02] years) than those in the intervention group (mean [SD] age, 68.59 [12.42] years), and the difference was statistically significant (*P* = .011). Comorbidities did not differ between the groups except for hypercholesterolemia, neither did Charlson comorbidity scores, AF-related treatment, or gender. Use of NOACs differed significantly between the 2 groups (Table 1).

### Resource Utilization and Costs

There was a tendency to equal or lower AF-related resource utilization in favor of the intervention group (Table 2). The control group had 3.02 outpatient visits on average, and the intervention group had 2.48. The control group spent 2.49 in-hospital days, whereas

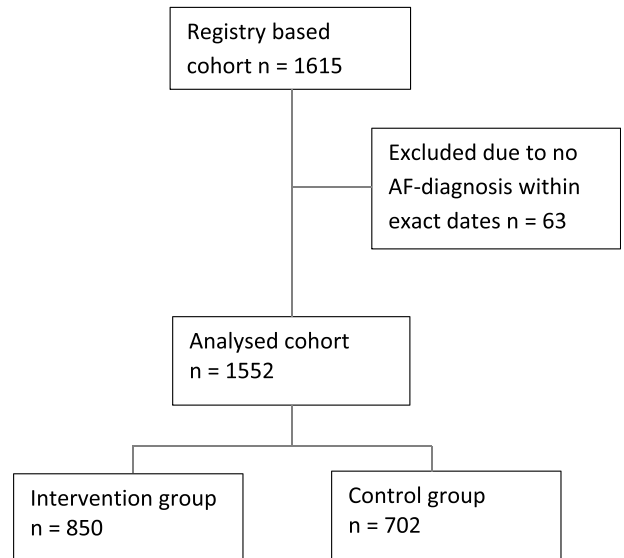


FIGURE 2. Flowchart.

the intervention group spent 2.05 (incidence risk ratio [IRR], 0.84; 95% confidence interval [CI], 0.72–0.99; *P* = .040).

Atrial fibrillation–related costs of admissions were significantly higher in the control group compared with those in the intervention group at €2366 versus €2939 (GLM estimate, 554.9; 95% CI, 134.1–989.5; *P* = .009), whereas unplanned admission costs were not significantly different at €1418 in the control group versus €1303 in the intervention group. Average outpatient costs were higher in the control group than in the intervention group at €522 versus €344 (GLM, 93.8; 95% CI, –219.7 to –24.49; *P* = .003). Total AF-related costs were €2746 for the control group and €3154 for the intervention group, which was not statistically significant (Table 2).

Resource use in the cardiology department, including all contacts independent of diagnoses, admissions, unplanned admissions, outpatient visits, and in-hospital days, was lower at the absolute scale on average in the intervention group (Table 3). The differences were not statistically significant when controlling for confounders, except for in-hospital days where the control group had 4.84 days and the intervention group had 3.90 days (IRR, 0.80; 95% CI, 0.69–0.91; *P* < .001).

The total costs of admissions to the cardiology department were slightly lower in the control group compared with the intervention group (€5354 vs €5794), which was not statistically significant (Table 3). Outpatient costs were significantly higher for the control group than for the intervention group at €1015 versus €648 (GLM, –241.2; 95% CI, –368.7 to –122.9; *P* < .001). The total costs of heart-related resource utilization were not significantly different in the control group compared with those in the intervention group at €6339 versus €6416.

**TABLE 1** Baseline Characteristics

	Control Group, 2009–2011 (n = 702)	Intervention Group, 2013–2015 (n = 850)	P2
Gender, male, %	433 (61.7)	513 (60.4)	.630
Age, mean (SD), y	66.89 (14.02)	68.59 (12.42)	.011 <sup>a</sup>
Comorbidities, n (%)			
Heart failure <sup>b</sup>	<3	0 (0.0)	
Thyrotoxicosis	5 (0.7)	4 (0.5)	.533
Ischemic heart disease	23 (3.3)	31 (3.6)	.692
Myocardial infarction	9 (1.3)	11 (1.3)	.983
Hypertension	75 (10.7)	83 (9.8)	.551
Diabetes	14 (2.0)	20 (2.4)	.631
Hypercholesterolemia	5 (0.7)	16 (1.9)	.047 <sup>a</sup>
Ventricular dysrhythmia	4 (0.6)	6 (0.7)	.739
Supraventricular dysrhythmia	14 (2.0)	9 (1.1)	.129
Charlson comorbidity index, n (%)			
No comorbidity, 0	676 (96.3)	812 (95.5)	.530
Moderate comorbidity, 1–2	26 (3.7)	37 (4.4)	.606
Severe comorbidity, ≥3	0 (0.0)	<3	
Treatment, n (%)			
DC cardioversion	0 (0.0)	<3	
Pharmacological treatment, n (%)			
NOACs <sup>c</sup>	0 (0.0)	105 (12.4)	<.001 <sup>d</sup>
Warfarin	165 (23.5)	178 (20.9)	.226
Platelet inhibitors	81 (11.5)	101 (11.9)	.834

Categorical variables are presented as percentages, analyzed using  $\chi^2$  test. Continuous variables are presented as mean (SD), analyzed using Student *t* test. Abbreviations: DC, direct current; NOACs, non-vitamin K antagonist oral anticoagulants.

<sup>a</sup>  $P < .05$ .

<sup>b</sup> Patients with heart failure are low, as those are followed in a dedicated heart failure clinic.

<sup>c</sup> NOAC was not available before 2011.

<sup>d</sup>  $P < .001$ .

## Exploratory Outcomes

The mortality rate during follow-up was 11.3% in the control group compared with 10.5% in the intervention group (Table 4), which was not statistically significant (hazard ratio, 0.86 [95% CI, 0.63–1.16]) when adjusting for confounders, as was also demonstrated in the Kaplan-Meier curve (Figure 3). There were no ischemic strokes during follow-up and only very few intracranial hemorrhages; thus, we did no further analyses on these outcomes (not reported in the table, to secure anonymity of patients).

## DISCUSSION

The main finding of this study was that costs of AF-related hospital resource utilization were lower in the control group with usual care than in the intervention group undergoing multidisciplinary AF management, although the difference was not significant. Furthermore, there was a trend toward lower all-cause mortality in the intervention group. Inpatient days were lower in the intervention group. On the other hand, patients in the intervention group experienced at least 1 AF-related outpatient visit during follow-up, but the average number of visits per patient was lower in the intervention

group, which was also true for costs of AF-related outpatient visits. As to total heart-related costs, patients with a first-time diagnosis of AF before the introduction of the AF clinic had similar costs per patient on average (€6339) as the patient group after the introduction of the AF clinic (€6416).

## Comparison of Findings to Other Studies and Implications

Patients in the control group were significantly younger than patients in the intervention group. The higher number of patients in the intervention group could be explained by a change in the referral pattern after the establishment of the AF outpatient clinic, resulting in more referrals from general practitioners.

As a consequence of the increased number of patients given a diagnosis of AF, costs of healthcare are expected to increase in the next decades. The main cost triggers are unplanned visits and hospital admissions,<sup>19</sup> which is in line with our results. Le Heuzey et al<sup>20</sup> argued for outpatient care programs for patients with AF to avoid readmissions and to reduce treatment costs. After the AF clinic was established, there was no significant reduction of planned admission in our study, whereas Conti et al<sup>4</sup> showed that an approach including outpatient

**TABLE 2** Atrial Fibrillation–Related Hospital Resource Utilization and Costs

	Control Group (n = 702)	Intervention Group (n = 850)	Intervention vs Control, Unadjusted		Intervention vs Control, Adjusted	
			IRR (95% CI)	P	IRR (95% CI)	P
AF-related resource use in the department of cardiology per patient						
No. admissions, mean (SD)	0.76 (0.86)	0.76 (0.93)	0.99 (0.89–1.12)	.972	1.03 (0.92–1.16)	.574
Unplanned admissions, mean (SD) <sup>a</sup>	0.52 (0.66)	0.47 (0.68)	0.89 (0.77–1.02)	.081	0.90 (0.79–1.03)	.130
No. in-hospital days, mean (SD)	2.49 (3.92)	2.05 (3.34)	0.82 (0.70–0.97)	<b>.017<sup>a</sup></b>	0.84 (0.72–0.99)	<b>.040<sup>a</sup></b>
No. outpatient visits, mean (SD)	3.02 (7.06)	2.48 (4.79)	0.82 (0.66–1.01)	.067	0.85 (0.69–1.05)	.118
AF-related costs in the department of cardiology, mean € per patient						
			Coefficient, GLM (95% CI)	P	Coefficient, GLM (95% CI)	P
Admission costs	€2366 (4842.6)	€2939 (5533.1)	572.8 (54.2–1100.2)	<b>.03<sup>a</sup></b>	554.9 (134.1–989.5)	<b>.009<sup>b</sup></b>
Unplanned admission costs	€1418 (3866.3)	€1303 (3550.0)	–115.0 (–507.32 to 255.8)	.546	1.16 (–378.2 to 376.0)	.99
Outpatient costs	€552 (1226.9)	€344 (698.2)	–208.2 (–314.6 to –113.3)	<b>&lt;.001<sup>c</sup></b>	–93.8 (–219.7 to –24.49)	<b>.003<sup>b</sup></b>
<b>Total AF-related costs</b>	<b>€2746 (4858.9)</b>	<b>€3154 (5670.9)</b>	<b>407.8 (–121.1 to 937.6)</b>	<b>.128</b>	<b>420.5 (–114.5 to 964.6)</b>	<b>.120</b>

Estimates were adjusted for age, gender, and comorbidities (hypertension, ventricular dysrhythmia, ischemic heart disease, myocardial infarction, hypercholesterolemia, renal disease, heart failure, diabetes, chronic obstructive pulmonary disease).

Bold values indicates statistically significant.

Abbreviations: AF, atrial fibrillation; CI, confidence interval; GLM, generalized linear models; IRR, incidence rate ratio.

<sup>a</sup> P < .05.

<sup>b</sup> P < .01.

<sup>c</sup> P < .001.

**TABLE 3** Heart-Related Hospital Resource Utilization and Costs

	Control Group (n = 702)	Intervention Group (n = 850)	Intervention vs Control, Unadjusted		Intervention vs Control, Adjusted	
			IRR (95% CI)	P	IRR (95% CI)	P
Resource use in the department of cardiology						
No. admissions, mean (SD)	1.24 (1.06)	1.16 (1.07)	0.93 (0.85–1.02)	.13	0.95 (0.87–1.04)	.261
Unplanned admissions, mean (SD) <sup>a</sup>	0.87 (0.90)	0.73 (0.85)	0.84 (0.75–0.94)	<b>.002<sup>b</sup></b>	1.01 (0.77–0.91)	.88
No. in-hospital days, mean (SD)	4.84 (7.27)	3.90 (5.40)	0.80 (0.70–0.93)	<b>.003<sup>b</sup></b>	0.80 (0.69–0.91)	<b>.001<sup>b</sup></b>
No. outpatient visits, mean (SD)	5.62 (9.76)	4.87 (7.68)	0.87 (0.74–1.02)	.09	0.90 (0.76–1.05)	.18
Heart-related costs, mean € per patient						
			Coefficient, GLM (95% CI)	P	Coefficient, GLM (95% CI)	P
Admission costs	€5364 (9821.6)	€5794 (10050.2)	430.3 (–573.1 to 1424.6)	.394	721.0 (–289.7 to 1735.8)	.154
Unplanned admission costs	€3491 (7506.2)	€3476 (8221.6)	–14.71 (–830.13 to 776.89)	.971	–26.22 (–864.6 to 925.0)	.953
Outpatient costs	€1015 (1616.86)	€648 (945.0)	–367.19 (–505.3 to –239.6)	<b>&lt;.001<sup>c</sup></b>	–241.2 (–368.7 to –122.9)	<b>&lt;.001<sup>c</sup></b>
<b>Total heart-related costs</b>	<b>€6339 (10157.3)</b>	<b>€6416 (10199.1)</b>	<b>77.36 (–956.6 to 1092.5)</b>	<b>.881</b>	<b>436.06 (–603.4 to 1467.7)</b>	<b>.399</b>

Estimates were adjusted for age, gender, comorbidities (hypertension, ventricular dysrhythmia, ischemic heart disease, myocardial infarction, hypercholesterolemia, renal disease, heart failure, diabetes, chronic obstructive pulmonary disease).

Bold values indicates statistically significant.

Abbreviations: CI, confidence interval; GLM, generalized linear models; IRR, incidence rate ratio.

<sup>a</sup> P < .05.

<sup>b</sup> P < .01.

<sup>c</sup> P < .001.

**TABLE 4** Mortality (All-Cause Mortality of Patients With Atrial Fibrillation)

	Control Group (n = 702)	Intervention Group (n = 850)	Intervention vs Control, Unadjusted		Intervention vs Control, Adjusted	
			Hazard Ratio (95% CI)	P	Hazard Ratio (95% CI)	P
No. (%) patients dead within follow-up	79 (11.3)	89 (10.5%)	0.93 (0.69–1.26)	.633	0.86 (0.63–1.16)	.318

Estimates were adjusted for age, gender, and comorbidities (hypertension, ventricular dysrhythmia, ischemic heart disease, myocardial infarction, hypercholesterolemia, renal disease, heart failure, diabetes, chronic obstructive pulmonary disease). Abbreviation: CI, confidence interval.

clinics for elective treatment of AF and short-term follow-up significantly reduced admissions irrespective of independent predictors of hospitalizations. There might be also organizational and political factors influencing planned admission, which might differ between countries and can explain why we do not reach similar results.

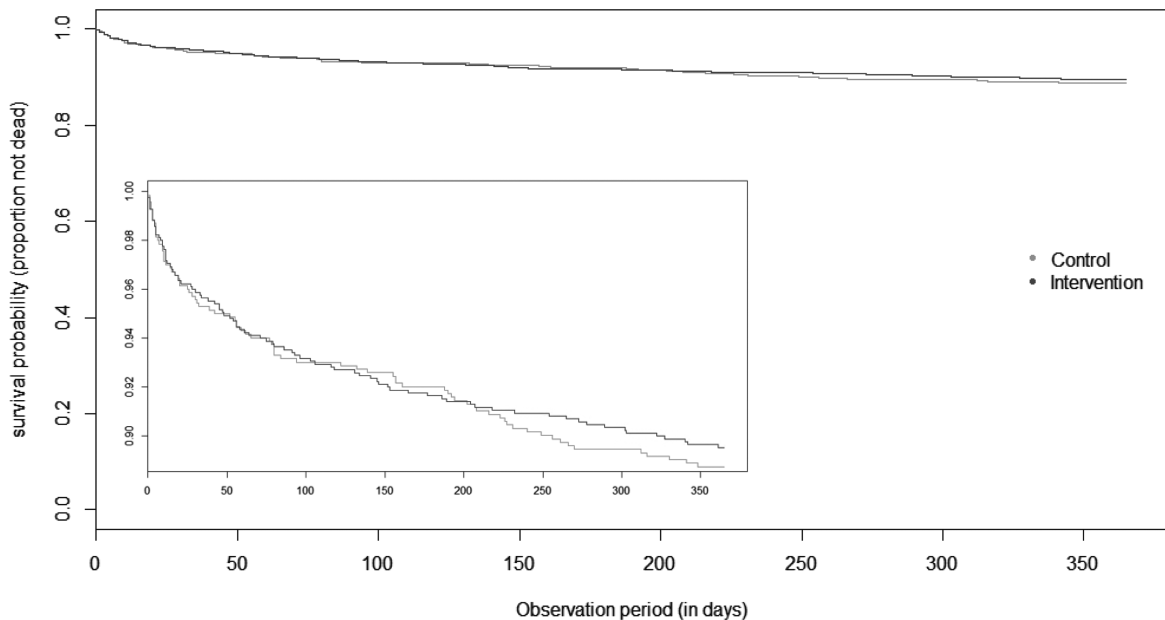
Our study shows that including AF nurse specialists in the multidisciplinary team does not result in an increased number of AF-related outpatient visits or AF-related admissions compared with physician-led usual care. Neither the 2006 American College of Cardiology/American Heart Association/European Society of Cardiology guidelines for the management of patients with AF<sup>21</sup> nor the 2010 guidelines for the management of AF<sup>22</sup> mentioned a multidisciplinary team approach or integrated AF care, whereas the 2016 ESC guidelines<sup>23</sup> highlighted the importance of integrated management of patients with AF where nurses play an important role in educating and coordinating care of patients with AF in collaboration with physicians.<sup>24</sup> Although we do not find a positive effect on the economic measures, the organizational change in the intervention group was ahead of its time,

because it used the multidisciplinary clinic before guidelines advised organizing this way.

In our study, we, investigating a real-world setting, did not find a significantly decreased risk of all-cause mortality when comparing with physician-led usual AF care. These findings are different from those in the study by Hendriks et al,<sup>25</sup> which demonstrated that a nurse-led AF clinic reduced mortality compared with usual care. In a recent study, the results of the randomized study by Hendriks et al<sup>25</sup> were compared with a nurse-led AF clinic in a real-world setting.<sup>26</sup> This study found that patient outcomes in the real-world setting were comparable with those from the randomized trial, but health-care costs were not included in the analysis.<sup>26</sup>

**STRENGTHS AND LIMITATIONS**

The inclusion criterion of the study was patients with a first-time diagnosis of AF, and the study took place in a routine clinical practice setting. Hence, the study population is likely to be representative of the actual population of patients with AF.



**FIGURE 3.** Survival probability during 1 year since first atrial fibrillation diagnosis (Kaplan-Meier curve). Note that figure within figure has y-axis of 0.9–1.0.



### What's New and Important

- Including AF nurse specialists in a multidisciplinary AF outpatient clinic does not result in increased number of AF-related outpatient visits or in AF-related admissions compared with physician-led usual care.
- Although hospitalization costs were higher for the nurse-led AF clinic, there were fewer inpatient days and a trend toward lower all-cause mortality in the intervention group.

We assumed that the intervention group was treated in the AF clinic, but as data were extracted from registries, it is possible that a few patients were given their diagnoses and treated at the hospital, without receiving the specialized AF care. Furthermore, at the time when the control group was managed, the 2006 AF guidelines<sup>27</sup> were in effect. The intervention group was managed under the 2010 ESC guidelines<sup>1</sup> and the 2012 update,<sup>28</sup> which might have affected the results of this study. In this case, results would represent a trend in time instead of an effect derived on the basis of the AF clinic. For example, outpatient costs are significantly lower for the intervention group and do not accurately correspond to the difference in resource utilization. This difference might be due to changes in reimbursement at the time, where the Diagnostic Related Group fee of a standard outpatient visit went from €171 in 2011 to €103 in 2015. For AF-related admissions, the average number per patient was equal, but costs were higher for the intervention group. This inconsistency can be due to a focus on detailed registration in the intervention group or to residual confounding following the age difference between groups. The organization of the healthcare sector is not static, and this might affect the result when using historical control groups.

The treatment groups differed significantly in age, and it is likely that residual confounding may follow an age difference. A possibility of correcting for different characteristics of patients in the 2 treatment groups could be matching the groups on extrinsic factors, for example, by the frequency distribution of age.<sup>29</sup> In this study population, matching would most likely reduce the number of included patients, and we were focused on a large patient population.

Results on resource use were presented on both department level and diagnosis level. This distinction was made, because of the risk of omitting large amounts of data. The contact registrations might not be accurate on diagnosis level. The results should be interpreted with this in mind.

There was an increase in the volume of patients in the intervention group, and more resources would have to be allocated to the hospital department to meet the higher demands. This was not incorporated in the analysis.

The perspective of the analysis was the hospital; thus, only hospital costs were collected. Thus, costs for primary sector services and pharmaceutical costs were not

taken into account when calculating total treatment costs. The reason for this was that most effects were expected within the hospital sector and that the AF clinic was an outpatient clinic based on the hospital.

The retrospective control intervention study design has a limitation by using a historical control group, which may differ in both observable and unobservable factors. The results were adjusted for a number of confounders, but it was not possible to control for factors such as educational level, income level, or attachment to the labor market. In addition, organizational or economic changes at the hospital during the years studied were not considered in the analysis. Among treatment regimen changes, new medical interventions (eg, NOAC) became available during the study period. This might affect the results. Hence, the internal validity might be weak. Whereas a randomized controlled trial design could strengthen internal validity, the retrospective study design made it possible to assess the effectiveness of the treatment in a real-world setting, which is a strength in terms of external validity. On the other hand, it was not possible in a real-world setting to gain data about specific issues such as patient knowledge evaluation, the true costs per working hour for physicians and nurses, equipment costs, or the qualification and fluctuation of the physicians in the historical group.

The study was a single-center study, which might limit the generalizability to organizations with similar clinical management and reimbursement systems.

### CONCLUSION

Costs of AF-related hospital resource utilization were higher in patients receiving multidisciplinary AF care than in patients receiving usual care, although the difference was not statistically significant. Furthermore, there was a slight difference in all-cause mortality in favor of the patients receiving multidisciplinary AF care. Overall, we did not find significant economic differences and could not confirm our hypothesis that a dedicated outpatient clinic with a multidisciplinary team can reduce AF-related healthcare costs within the hospital. More research assessing the cost-effectiveness of a multidisciplinary approach for patients with AF in real-world settings is needed. Finally, studies investigating patients' perceived quality of treatment are needed to expand the evidence in the field.

### REFERENCES

1. European Heart Rhythm Association; European Association for Cardio-Thoracic Surgery, Camm AJ, Kirchhof P, Lip GY, et al. Guidelines for the management of atrial fibrillation: the task force for the management of atrial fibrillation of the European Society of Cardiology (ESC). *Eur Heart J*. 2010;31(19):2369–2429.
2. Reynolds MR, Essebag V, Zimetbaum P, Cohen DJ. Healthcare resource utilization and costs associated with recurrent episodes of atrial fibrillation: the FRACTAL registry. *J Cardiovasc Electrophysiol*. 2007;18(6):628–633.

3. Reynolds MR, Morais E, Zimetbaum P. Impact of hospitalization on health-related quality of life in atrial fibrillation patients in Canada and the United States: results from an observational registry. *Am Heart J*. 2010;160(4):752–758.
4. Conti A, Canuti E, Mariannini Y, et al. Clinical management of atrial fibrillation: early interventions, observation, and structured follow-up reduce hospitalizations. *Am J Emerg Med*. 2012;30(9):1962–1969.
5. Ismail H, Coulton S. Arrhythmia care co-ordinators: their impact on anxiety and depression, readmissions and health service costs. *Eur J Cardiovasc Nurs*. 2016;15(5):355–362.
6. Hendriks J, Tomini F, van Asselt T, Crijns H, Vrijhoef H. Cost-effectiveness of a specialized atrial fibrillation clinic vs. usual care in patients with atrial fibrillation. *Europace*. 2013;15(8):1128–1135.
7. Rush KL, Burton L, Schaab K, Lukey A. The impact of nurse-led atrial fibrillation clinics on patient and healthcare outcomes: a systematic mixed studies review. *Eur J Cardiovasc Nurs*. 2019;18(7):526–533.
8. Körner M. Interprofessional teamwork in medical rehabilitation: a comparison of multidisciplinary and interdisciplinary team approach. *Clin Rehabil*. 2010;24(8):745–755.
9. Pedersen CB. The Danish civil registration system. *Scand J Public Health*. 2011;39(7, suppl):22–25.
10. Lyng E, Sandegaard JL, Rebolj M. The Danish National Patient Register. *Scand J Public Health*. 2011;39(7, suppl):30–33.
11. Hallas J, Hellfritsch M, Rix M, Olesen M, Reilev M, Pottegård A. Odense Pharmacoepidemiological Database: a review of use and content. *Basic Clin Pharmacol Toxicol*. 2017;120(5):419–425.
12. Marshall DA, Levy AR, Vidaillet H, et al. Cost-effectiveness of rhythm versus rate control in atrial fibrillation. *Ann Intern Med*. 2004;141(9):653–661.
13. Hertzum M, Ellingsen G. The implementation of an electronic health record: comparing preparations for Epic in Norway with experiences from the UK and Denmark. *Int J Med Inform*. 2019;129:312–317.
14. Drummond Michael F, Sculpher Mark J, Claxton Karl, Stoddart Greg L, Torrance GW. *Methods for the Economic Evaluation of Health Care Programmes*. Oxford, England: University Press; 2015.
15. Local Government Denmark. *Den Kommuneale Pris-og Lønudvikling, 2017–2022*. Copenhagen, Denmark: Ministry of Social Affairs and the Interior; 2014. <https://www.kl.dk/media/7540/pl-skema-juni-2018.pdf>.
16. Gregori D, Petrinco M, Bo S, Desideri A, Merletti F, Pagano E. Regression models for analyzing costs and their determinants in health care: an introductory review. *Int J Qual Health Care*. 2011;23(3):331–341.
17. Cameron AC, Trivedi PK. *Regression Analysis of Count Data*. New York, NY: Cambridge Press; 1998.
18. Therneau T, Grambsch P. *Modeling Survival Data: Extending the Cox Model*. New York, NY: Springer; 2000.
19. Rienstra M, Van Gelder IC. A specialized atrial fibrillation clinic: improving care and costs for patients with atrial fibrillation. *Europace*. 2013;15(8):1065–1066.
20. Le Heuzey J-Y, Pazioud O, Piot O, et al. Cost of care distribution in atrial fibrillation patients: the COCAF study. *Am Heart J*. 2004;147(1):121–126.
21. Fuster V, Rydén LE, Cannom DS, et al. ACC/AHA/ESC 2006 Guidelines for the Management of Patients with Atrial Fibrillation: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the European Society of Cardiology Committee for Practice Guidelines (Writing Committee to Revise the 2001 Guidelines for the Management of Patients With Atrial Fibrillation): developed in collaboration with the European Heart Rhythm Association and the Heart Rhythm Society. *Circulation*. 2006;114(7):e257–e354.
22. Camm AJ, Kirchhof P, Lip GY, et al. Guidelines for the management of atrial fibrillation: the task force for the management of atrial fibrillation of the European Society of Cardiology (ESC). *Europace*. 2010;12(10):1360–1420.
23. Kirchhof P, Benussi S, Kotecha D, et al. 2016 ESC guidelines for the management of atrial fibrillation developed in collaboration with EACTS. *Eur Heart J*. 2016;33(38):2893–2962.
24. Hendriks JML, Heidebüchel H. The management of atrial fibrillation: an integrated team approach—insights of the 2016 European Society of Cardiology guidelines for the management of atrial fibrillation for nurses and allied health professionals. *Eur J Cardiovasc Nurs*. 2019;18(2):88–95.
25. Hendriks JML, de Wit R, Crijns HJGM, et al. Nurse-led care vs. usual care for patients with atrial fibrillation: results of a randomized trial of integrated chronic care vs. routine clinical care in ambulatory patients with atrial fibrillation. *Eur Heart J*. 2012;33(21):2692–2699.
26. Qvist I, Hendriks JML, Møller DS, et al. Effectiveness of structured, hospital-based, nurse-led atrial fibrillation clinics: a comparison between a real-world population and a clinical trial population. *Open Heart*. 2016;3(1):e000335.
27. Fuster V, Rydén LE, Cannom DS, et al. ACC/AHA/ESC 2006 guidelines for the management of patients with atrial fibrillation—executive summary. *Circulation*. 2006;114(7):700–752.
28. Camm AJ, Lip GY, De Caterina R, et al. 2012 focused update of the ESC guidelines for the management of atrial fibrillation: an update of the 2010 ESC guidelines for the management of atrial fibrillation. Developed with the special contribution of the European Heart Rhythm Association. *Eur Heart J*. 2012;33(21):2719–2747.
29. Frankfort-Nachmias C, Nachmias D. *Research Methods in the Social Sciences*. 7th ed. New York, NY: Worth Publishers; 2008.