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Economic Evaluation

Burden of Providing Informal Care for Patients with Atrial Fibrillation

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ABSTRACT

Objectives: Patients with atrial fibrillation (AF) have rapid and irregular heart rates, increasing the risk of comorbidities and mortality. Next to formal medical care, many patients receive informal care from their social environment. The objective of this study was to examine the well-being and economic burden of providing informal care to patients with AF in the UK, Italy, and Germany.

Methods: Caregivers of patients with AF completed an online survey based on the iMTA Valuation of Informal Care Questionnaire, with questions about their caregiving situation, perceived burden of caregiving, and absence from work due to health problems resulting from caregiving. Care-related quality-of-life utilities were calculated using the Care-related Quality of Life instrument and associated tariffs. Societal costs of caregiving were calculated based on the proxy good method.

Results: A total of 585 caregivers participated in this study. On average, caregivers provided 33 hours of informal care per week to patients (SD 29 hours). On a scale from 0 to 10, their self-rated burden was 5.4. The average Care-related Quality of Life utility was 72. Caregivers primarily indicated problems with daily activities, mental health, and physical health. Still, the vast majority of caregivers (87%) derived fulfillment from providing care. Weekly societal costs of caregiving were on average €636. Comorbidities contributed substantially to the caregiver time and burden.

Conclusions: Caring for a patient with AF is associated with substantial objective and subjective burden, but also provides fulfillment from being able to care for a loved one.

Keywords: atrial fibrillation, caregiver burden, informal care, societal costs.

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Introduction

Atrial fibrillation (AF) is a condition in which the heart rate is rapid and irregular. In 2010, more than 33 million people worldwide had AF.¹ The number of patients with AF over the age of 55 years in the European Union is estimated to increase from 8.8 million in 2010 to 17.9 million in 2060.² In Australia, patient numbers are projected to double by 2050.³ AF-related hospitalizations have been increasing rapidly over the last years.^{3,4} Patients with AF have an increased risk of other conditions such as stroke and heart failure.^{5,6} Furthermore, AF is associated with increased mortality risk.^{6,7} Also, patients with AF have a reduced quality of life compared with the general population.⁸ Patients with AF more frequently receive assistance from a caregiver than age-matched controls, which is also related to the high frequency of comorbidities.⁹ As such, the condition not only affects the patient, but the patient's social environment as well. Care provided by the patient's social environment and not in a professional capacity is called informal care. Providing informal care can have both negative and positive effects on the caregiver's well-being.¹⁰ On the one hand, providing care might be burdensome, as caregivers have to invest time to care for the patient or might need to

perform tasks with which they are not comfortable. In addition, providing informal care might lead to physical and mental health problems or financial difficulties for the caregiver. On the other hand, caregivers might appreciate providing care for their loved ones.¹¹ In addition to caregiver well-being effects, providing informal care has an economic societal impact, as time spent on providing informal care has an opportunity cost. In economic evaluations from a societal perspective, inclusion of costs related to informal care is therefore important.

The literature on the burden of caregiving for patients with AF is very limited. A literature review identified only 2 publications on informal care for patients with AF, with one study focusing on the need for informal care assistance and one study focusing on the burden of caregiving.¹² The latter study was conducted in the United States in 80 patients and their caregivers, and found that caregivers particularly had disrupted schedules and financial problems.¹³ Evidence of the burden of caregiving for patients with AF in other countries is not available, although cultural, demographic, and socioeconomic differences between countries might affect the supply of informal care and experienced burden for caregivers. This study aims to quantify the burden for caregivers of patients with AF in Germany, Italy, and the UK. The

Table 1. Time cost per hour (in Euro) of informal care and hourly labor costs in Italy, Germany, and UK (2019 values).

	Proxy good method	Source	Opportunity cost method	Source	Labor cost	Source
Italy	10.08	²²	8.41	²¹	28.37	²⁹
Germany	20.91	²³⁻²⁷	17.19	²⁴⁻²⁶	35.08	²⁹
UK	13.72	²¹	15.26	²¹	27.99	²⁹

current project on informal care in AF is the largest to date and the first to focus on Western European countries.

Methods

Study Population

German, Italian, and UK caregivers of patients with self-reported AF were recruited by an online sampling agency. German and UK respondents had indicated to provide care for a patient with AF before the start of the current study; Italian respondents were specifically asked to indicate this in the inclusion phase of the current study. Physician-confirmed diagnosis of AF was not requested in this sample. Only adult caregivers (18 years or older) who provided informal care in the last 2 consecutive weeks before completing the survey or longer were included in the sample. Data were collected in January 2020.

Measures

The iMTA Valuation of Informal Care Questionnaire (iVICQ) formed the main part of the caregiver survey. The iVICQ is a non-disease-specific instrument designed to measure the burden of providing care, which contains questions on the objective burden of caregiving, the subjective burden of caregiving, and the effects on the health and well-being of caregivers.¹⁴ The self-rated burden (SRB) instrument¹⁵ and the Care-related Quality of Life (CarerQoL) instrument¹⁶ are integral parts of the iVICQ questionnaire. The SRB examines the burden of caregiving on a scale from 0 (not at all straining) to 10 (much too straining). The CarerQoL instrument consists of 7 dimensions of caregiver burden with 3 levels (no, some, and a lot). In addition, questions on caregivers' activities of daily living were included, consisting of 11 dimensions of activities of daily living with 5 levels (ranging from "without difficulties" to "not even with help from others").

In addition to the burden-related questions, caregivers completed an amended version of the iMTA Productivity Cost Questionnaire (iPCQ), a non-disease-specific questionnaire to assess losses in productivity due to illness resulting from providing informal care.¹⁷ Only productivity losses due to illness resulting from providing care were considered; absence from work for the provision of care was excluded. Caregivers also were asked to answer questions about the patient they were caring for (eg, patient's age, gender, comorbidities, living situation, AF type). In the survey, no distinction was made regarding the origin of the need for informal care (ie, whether care was related to AF or to potential comorbidities).

The survey was made available in English, German, and Italian. In each of the 3 countries, the questionnaire was first tested in a small portion (10%) of the desired sample size. No major changes were needed after the initial testing phase. Respondents were asked to fill in the survey only once. Because of the cross-sectional study design, comparisons between treatments were not part of the analyses.

Analyses

Caregiver burden and quality of life

The objective burden was expressed in the volume (hours) of informal care provided. The subjective burden of caregiving was

assessed using the SRB and the CarerQoL instrument. The CarerQoL instrument was used to calculate caregiving utilities to describe care-related quality of life in a single utility value between 0 and 100.¹⁸ The CarerQoL tariffs are available for multiple countries, including Germany and the UK.¹⁹ For Italian caregivers, the UK dataset was used. Process utility was assessed to determine whether caregivers derived happiness from providing care.¹¹ This was calculated from the difference between the current happiness of the caregiver compared with the happiness of the caregiver if somebody were to take over the provision of informal care. Both questions were measured on a scale from 0 (completely unhappy) to 10 (completely happy). The process utility therefore ranges from -10 to 10, with negative values representing that caregivers would gain happiness if informal care tasks were conducted by others and positive values representing that caregivers derive happiness from providing informal care.

Informal care costs

The proxy good method was used to calculate time costs of caregiving. In the proxy good method, the unit cost of time represents the value of a close market substitute.²⁰ In a scenario analysis, informal care time was valued using the opportunity cost method. In this method, the unit cost of caregiver's time is set equal to the value of the time forgone.²⁰ Valuation of informal care time was taken from scientific literature, using different values for the 3 countries. The unit cost for UK and Italy (opportunity cost method) was derived from a systematic literature review,²¹ in which the Italian unit cost was set equal to the southern European unit cost estimate. The Italian unit cost for proxy good method was derived from a single Italian study.²² Several studies reported German unit costs,²³⁻²⁷ from which the average value was calculated. Table 1 provides the hourly unit cost used in the analyses. All costs are presented in 2019 values, when necessary inflation correction using Harmonised Consumer Price Index figures from Eurostat²⁸ was applied. Travel costs was set at €0.20 per kilometer.

To calculate the costs of lost productivity due to illness from providing informal care, hourly labor costs were derived from Eurostat²⁹ and are provided in Table 1. Lost productivity was calculated using the human capital method. In the human capital method, productivity losses are assumed to be incurred up to a person's retirement. In a scenario analysis, the friction cost method was used, in which productivity losses are limited to the period it takes to replace the absent worker. Costs of informal care time, travel, and productivity losses were expressed in cost per 1-week period.

Relationship between caregiver burden, health, and costs

To assess the relation between caregiver burden (total hours of informal care, SRB, CarerQoL utility, and total costs of informal care) and patients' health status, regression analyses were performed. In this respect, patient's health status (visual analogue scale), age, type of AF, duration of AF, whether patients lived in an institution, patient's comorbidities, and the

Table 2. Caregiver and patient characteristics.

	Total	UK	Italy	Germany
Long-term caregiver	585	200	189	196
Caregiver characteristics				
Gender (% female)	57.6	64.0	53.4	55.1
Age (y, mean)	46.8 [15.6]	51.2 [16.4]	44.2 [13.5]	44.9 [15.7]
Education				
Low (%)	4.3	3.0	3.2	6.6
Middle (%)	46.2	29.0	48.2	61.7
High (%)	49.6	68.0	48.7	31.6
Partner (% yes)	83.1	83.5	85.7	80.1
Number of children	1.2 [1.2]	1.4 [1.2]	1.0 [1.0]	1.1 [1.3]
Health status (VAS: 0-10)	6.6 [1.9]	6.6 [1.9]	7.1 [1.6]	6.2 [2.1]
Activities of daily living (sum: 11-55)	16.9 [8.1]	16.7 [7.9]	15.5 [6.8]	18.4 [9.1]
Paid work (% yes)	59.0	48.5	62.4	66.3
Patient characteristics				
Gender (% female)	49.7	50.0	50.3	49.0
Age (y, mean)	65.8 [20.5]	64.5 [21.1]	69.7 [17.0]	63.3 [22.4]
≥70 y (%)	54.5	50.5	64.0	49.5
Health status (VAS: 0-10)	4.4 [2.1]	4.3 [2.0]	4.8 [1.8]	4.1 [2.3]
Duration AF (y)	10.0 [11.6]	9.7 [9.2]	11.1 [14.9]	9.2 [10.0]
Type AF				
Paroxysmal (%)	18.0	18.5	15.9	19.4
Persistent (%)	24.6	17.0	30.2	27.0
Permanent (%)	45.5	48.5	42.3	45.4
Unknown to caregiver (%)	12.0	16.0	11.6	8.2
Comorbidity				
Yes (%)	92.7	92.0	92.1	93.9
No (%)	5.0	7.0	5.3	2.6
Unknown to caregiver (%)	2.4	1.0	2.7	3.6
Polymedication				
Yes (%)	79.2	82.5	71.4	83.2
No (%)	15.0	12.0	21.7	11.7
Unknown to caregiver (%)	5.8	5.5	6.9	5.1
Weight				
≤60 kg (%)	23.3	27.0	21.2	21.4
>60 kg (%)	71.5	61.5	77.8	75.5
Unknown to caregiver (%)	5.3	11.5	1.0	3.1

Note. Standard deviations are in brackets.

AF indicates atrial fibrillation; VAS, visual analogue scale.

duration of informal care were used as independent variables. The total hours of informal care were used as an additional independent variable in the analyses for SRB and CarerQol utility. Variables were included in the final model using backward regression. Backward selection has the risk of overfitting to the sample characteristics, but was mainly used as a tool to estimate burden of care within this sample attributable to AF. To resemble the skewness of the data for the dependent variables, a gamma generalized linear estimation (using log link and the gamma family) model was used. Model fit was assessed using visual inspection of density plots, mean absolute error, and root square mean error, and fit of both ordinary least squares and gamma generalized linear estimation models are presented in the [Appendix](#) in Supplemental Materials found at <https://doi.org/10.1016/j.jval.2020.09.011>.

Analyses were performed using Stata 16.0 (Statacorp, College Station, TX).

Results

Table 2 shows the characteristics of the caregivers and the patient they were caring for. The sample consisted of 585 caregivers (200 UK, 189 Italian, and 196 German caregivers). Caregivers were most often female and on average 47 years old (range 18-84). The majority of caregivers had a partner. Caregivers' problems with activities of daily living were limited.

Patients had an average age of 66 years; 41% of patients were 75 years of age or older. Patients had AF for 10 years, and almost 50% of patients had permanent AF. In all 3 countries, more than 92% of patients had one or more comorbidities, most often cardiovascular disease (55%), respiratory diseases (30%), arthrosis (28%), and diabetes (25%). Patient and caregiver characteristics were fairly similar between countries.

Table 3 shows the properties of informal care provided. The patient was the mother or father of the caregiver in 35% of cases,

Table 3. Informal care properties.

	Total	UK	Italy	Germany
Relationship with patient (%)				
Spouse	24.1	42.5	6.9	21.9
Mother or father	34.7	28.0	38.6	37.8
Mother-in-law or father-in-law	12.7	11.5	16.4	10.2
Daughter or son	3.3	3.5	0.5	5.6
Another family member	15.4	9.5	23.8	13.3
Other	9.9	5.0	13.8	11.2
Duration (mo, mean)	65.6 [73.7]	83.5 [84.0]	60.1 [65.5]	52.8 [66.3]
Days/wk (mean)	5.0 [1.9]	5.4 [1.9]	4.5 [2.0]	5.2 [1.8]
Objective burden (h/wk)				
Total hours of informal care*	33.2 [29.4]	37.3 [32.5]	30.5 [27.9]	31.6 [27.0]
Household activities	15.7 [14.6]	18.6 [15.5]	12.5 [12.4]	15.8 [15.0]
Personal care	8.8 [10.9]	9.9 [12.4]	8.9 [10.9]	7.6 [9.0]
Practical support	8.7 [10.4]	8.8 [11.1]	9.1 [10.6]	8.2 [9.5]
Hours by other informal caregivers	3.9 [13.1]	2.4 [8.7]	5.2 [16.7]	4.3 [12.5]
Opportunity time spent if not spent on caregiving (h/wk)				
Paid work	9.2 [15.9]	9.6 [18.5]	9.9 [15.7]	8.0 [13.0]
Unpaid work	10.1 [17.7]	13.2 [24.1]	7.5 [11.8]	9.3 [14.0]
Leisure time	13.9 [16.6]	14.5 [14.7]	13.1 [16.4]	14.2 [18.5]
Subjective burden				
Self-rated burden (0-10)	5.4 [2.5]	5.1 [2.7]	5.3 [2.3]	5.7 [2.4]
Process utility (-10 to 10)	0.1 [3.1]	0.5 [3.3]	0.0 [2.8]	-0.1 [3.1]
Negative process utility (%)	39.3	35.5	38.6	43.9
Neutral process utility (%)	22.2	24.0	26.5	16.3
Positive process utility (%)	38.5	40.5	34.9	39.8
CarerQol utility (0-100)	71.7 [19.5]	69.1 [19.5]	75.0 [18.9]	71.1 [19.7]

Note. Standard deviations are in brackets.

*For 18 respondents (3%), total hours of care were maximized at 126 h/wk (18 h/d × 7 d/wk), as a larger number of hours per week provided by a single caregiver was considered unrealistic.

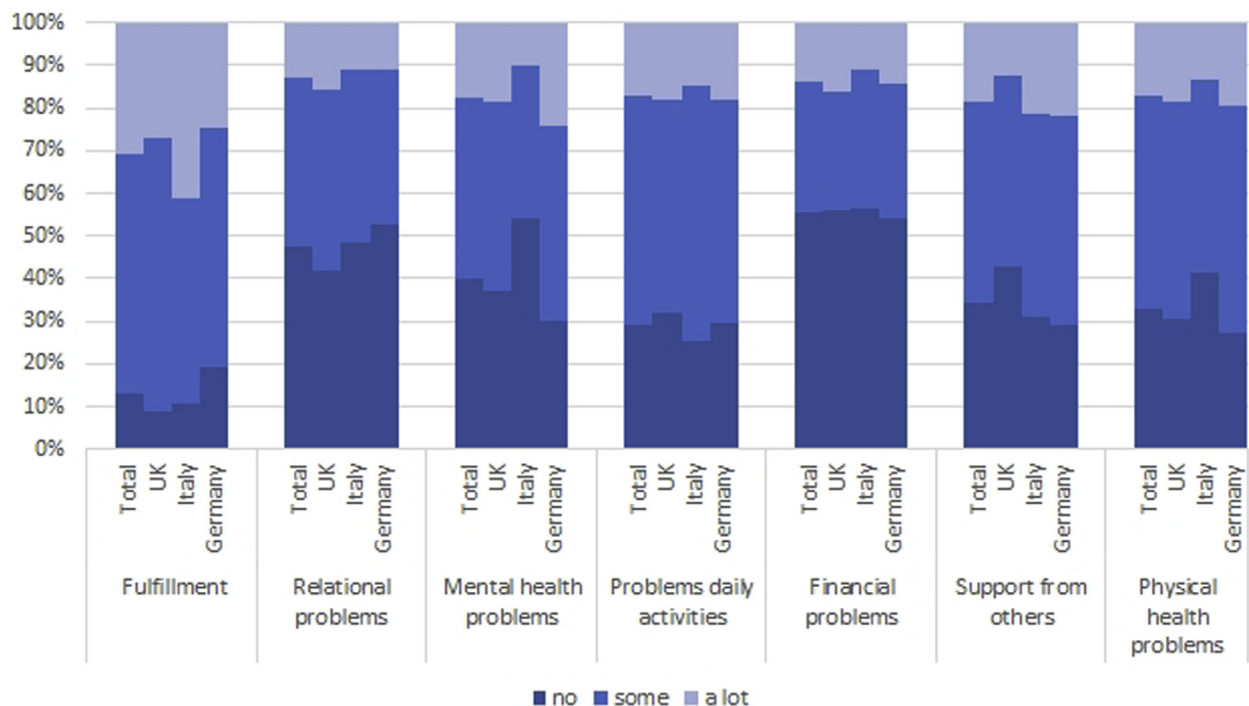
Figure 1. Scores on Care-related Quality of Life dimensions.

Table 4. Weekly costs of informal care (all costs in Euros, 2019 values).

	Total		UK		Italy		Germany	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Time costs (proxy good)	496	10-2635	512	14-1729	308	10-1270	660	63-2635
Travel costs	8	0-451	8	0-451	8	0-280	7	0-280
Productivity costs HCM	133	0-2487	98	0-1308	98	0-1704	203	0-2487
Total costs	636	14-3493	618	14-2997	414	20-1993	869	63-3493
Time costs (opportunity costs)	459	8-2166	570	15-1923	258	8-1060	542	52-2166
Productivity costs FCM	116	0-2487	84	0-1308	96	0-1704	166	0-2487

FCM indicates friction cost method; HCM, human capital method.

and in 24% the patient was the caregiver's spouse. Remarkable differences between countries were observed; in Italy the patient was the caregiver's spouse in less than 7% of the sample, whereas in the UK more than 42% of caregivers cared for their spouse. The average duration of caregiving was 66 months (5.5 years), with caregivers from the UK indicating care for a longer period than in the other countries.

On average, caregivers provided 33 hours of informal care per week, with substantial variation between caregivers (SD 29.4). Total hours of informal care had a right-skewed distribution, with some caregivers indicating many hours of care per week. The median volume of informal care provided was 22 hours per week. The differences in the average hours of informal care between countries were limited. Approximately half of the informal care time was spent on household activities (eg, food preparation, cleaning, or taking care of children), and the remainder was distributed evenly over personal care (eg, dressing, washing, or going to the toilet) and practical support (eg, healthcare visits, organizing help, or transportation). If not providing care,

caregivers would have spent this time on leisure (42%), unpaid work (30%), and paid work (28%).

Caregivers' self-rated burden was 5.4; 56% of caregivers had a burden of 5 or higher. Similar proportions of patients had a positive or negative process utility, signifying patients deriving or losing happiness from providing informal care, respectively. The average process utility was 0, indicating that, on average, caregivers' happiness was not affected by providing care. However, only 22% of caregivers had a process utility of 0, indicating that the average value did not reflect differences within the sample. Caregivers had an average caregiver utility of 72, which was similar between the countries studied. Still, there was considerable variation between caregivers (SD 19.5). The median caregiving utility was 75, and 36% of caregivers had a caregiver utility below 70.

Figure 1 shows the scores on the CarerQoL dimensions. The majority of caregivers (87%) derived some or a lot of fulfillment out of providing informal care. Problems in daily activities was the most frequently reported problem by caregivers; 71% of caregivers

Table 5. Regression output total hours of informal care, caregiver burden, CarerQoL utility, and total costs of informal care.

	Total hours		Caregiver burden		CarerQoL utility		Total costs	
	Coeff	P value	Coeff	P value	Coeff	P value	Coeff	P value
Constant	41.075	<.001	4.457	<.001	57.654	<.001	1452.001	<.001
Patient's health (VAS 0-10)	NS		NS		1.012	.044	0.942	.001
Patient's age	0.995	.002	NS		1.004	<.001	0.988	<.001
Duration AF	NS		1.005	.009	0.998	.023	NS	
Paroxysmal AF	NS		NS		NS		NS	
Permanent AF	NS		0.893	.005			NS	
Patient institutionalized	NS		1.181	.006	0.925	.025	NS	
Cardiovascular comorbidity	NS		NS		NS		NS	
Arthrosis comorbidity	NS		1.129	.006	NS		NS	
CNS comorbidity	NS		NS		NS		NS	
Cancer comorbidity	NS		1.139	.030	0.933	.038	NS	
Diabetes comorbidity	1.238	.009	1.167	.001	NS		1.397	<.001
Respiratory comorbidity	1.294	.001	NS		0.948	.026	1.325	<.001
Other comorbidities	NS		NS		NS		NS	
Duration informal care	NS		0.999	.022	NS			
Total hours informal care			1.003	<.001	0.999	<.001		

AF indicates atrial fibrillation; CarerQoL, Care-related Quality of Life; CNS, central nervous system; NS, nonsignificant; VAS, visual analogue scale.

reported some or a lot of problems in this area. Most caregivers experienced some or a lot of mental or physical health problems (60% and 67%, respectively). Scores on CarerQol dimensions were largely comparable between countries; only on the mental and physical health dimensions did the Italian caregivers slightly deviate from caregivers in the UK and Germany.

Table 4 shows the costs associated with providing informal care. Total costs of informal care were on average €636 per week, varying as €414 in Italy, €618 in the UK, and €869 in Germany. The average hides substantial differences between caregivers (range €14–€3493). As is often the case for cost estimates, the distribution of costs is skewed with relatively low costs for many caregivers and high costs for a few caregivers. The median costs of informal care per week were €432. Time costs calculated with the proxy good method were approximately €500. There were remarkable differences between countries; German time costs were more than twice as much as Italian costs. Because caregiving time was similar, the differences were explained by the differences in valuation of informal care time. Travel costs were limited, because caregivers and patients shared a household (59%) or caregivers lived near the patient. In total, 59% of caregivers had a paid job. Productivity costs due to illness resulting from informal care were €133 per week. Long-term absence was the biggest contributor of total productivity costs (€55 per week; 42% of total productivity costs). Unpaid work (€38 per week; 29%), short-term absence (€20; 15%) and presenteeism (€19; 15%) were the other components of productivity costs. Productivity costs were higher in Germany than in the UK and Italy because of the higher wage rates in Germany. Furthermore, German caregivers most frequently had a paid job (Table 2). When using the opportunity costs method to value informal care time, care time costs were slightly lower compared with using the proxy good method. Using the friction cost method rather than the human capital method resulted in lower productivity costs because productivity costs for caregivers with long-term absences were zero in the friction cost method.

Table 5 shows the results of the regression analyses with the total hours of informal care, caregiver burden, CarerQol utility values, and total costs of informal care as dependent variables. Patient's age was negatively related to the total hours of care. Patients who had comorbid diabetes and respiratory diseases received 1.2 times and 1.3 times more hours of informal care each week, respectively, compared with patients without these comorbidities. Other comorbidities did not significantly affect the hours of informal care received. Caregiver burden was positively associated with duration of AF. Caregiver burden was higher for caregivers who provided care to patients with arthrosis, cancer, diabetes. In addition, caregiver burden was higher for patients who were institutionalized and lower for patients who had permanent AF. Caregiver burden was negatively associated with duration of informal care. The total hours of informal care provided were positively related to caregiver burden. Caregivers for institutionalized patients had a lower CarerQol utility than caregivers for patients who were living at home. Caregivers for patients with respiratory comorbidity also had a lower CarerQol utility than caregivers for patients without respiratory comorbidity. Total hours of care and duration of AF were negatively associated with CarerQol utility. Total informal care costs were lower for caregivers of patients with worse health status and older patients. Informal care costs for caregivers of patients with cardiovascular, diabetes, and respiratory comorbidities were higher than for caregivers of patients without these comorbidities.

When canceling out the effects of comorbidities and other significant predictors, and using the average population values,

the expected hours of care, caregiving burden, CarerQol utility, and costs of informal care were related to AF. The predicted hours of care related to AF were 29.5 per week. Caregiver burden related to AF was 4.5. AF-related CarerQol utility was 73.9, and costs related to informal care for AF were €504 per week.

Discussion

Comparison with Other Studies

The current study on AF caregivers was the largest to date and conducted in real-world populations in Germany, Italy, and the UK ($n = 585$). The median age (71 years in the current study vs 70–73 years in the clinical trials) was similar compared with the large trial populations with anticoagulants (nonvitamin K antagonist oral anticoagulants; NOACs) for the treatment of AF, but the proportion of women in this study (ie, 50%) was higher than in the nonvitamin K antagonist oral anticoagulants clinical trials (36%–40% female patients).^{30–33} The proportion of patients with paroxysmal AF in the current study (18%) was in the range of the proportion observed in the clinical trials (15%–33%). Importantly, most patients had comorbidities both in the current study and in the pivotal trials. Similar to the pivotal trials, most patients (55%) in the current study had cardiovascular comorbidities, but specific disease comorbidities could not be singled out in the current study, complicating a more detailed comparison with the pivotal trials.

One earlier study by Coleman et al examined the burden of caregiving for patients with AF in the United States.¹³ Coleman et al did not present the absolute hours of informal care provided. In their study, 40% of caregivers provided care for more than 4 hours per week, whereas in this study more than 96% of caregivers indicated to provide this amount of care, which showed that the absolute burden of caregiving might be higher in the current study. Caregiver burden dimensions were measured with a different instrument and on a different scale. Burden was mostly related to “disrupted schedule” in the US study and “problems with daily activities” in the current study, which appear to be similar dimensions. The burden of informal care has been studied in related indications. A systematic review found 5 studies on caregivers for stroke survivors, who received on average of 24 hours of care per week.²¹ Self-rated burden in caregivers for Dutch stroke survivors was much lower than the SRB in caregivers for patients with AF (2.9 rescaled to 0–10 scale vs 5.4, respectively), and caregivers provided less care for stroke survivors than for patients with AF (23.8 hours vs 33.2 hours, respectively).³⁴ Spanish stroke survivors received 51.2 hours of care per week, and thus received more care per week than patients with AF.³⁵ Patients with symptomatic chronic heart failure received 44.9 hours of informal care per week from their informal caregiver.³⁶ Nonetheless, precaution is necessary when making international comparisons due to demographic, cultural, and socioeconomic differences between countries.

This study found an average CarerQol utility value of 71.7. A systematic literature review assessed caregiver utilities with the CarerQol and other instruments.³⁷ Mean CarerQol utility values ranged from 79.2 in the Dutch population with caregivers for nonspecified diseases, 84.7 for mothers and 89.2 for fathers of patients with cystic fibrosis in Ireland, and 70.1 for caregivers providing care for Dutch patients with dementia. Median values in Dutch nonspecified diseases were 83.1 and in Dutch patients in rehabilitation were 83.9 compared with the median value in the current study of 75.3. Except for the caregivers of patients with dementia, CarerQol utilities were thus lower than in other populations. This might be explained by the large proportion of

patients with comorbidities in the current study, which is commonly observed in AF.

Limitations

The sample consisted of self-reported caregivers. Physician-confirmed AF diagnosis was not requested, but respondents were allowed to confirm the diagnosis with the patient or a physician. The survey contained questions about patients' health, comorbidities, and AF characteristics. Although there was an opt-out option for most questions, caregivers might have had difficulties in answering these questions and might have provided lower-quality responses than a physician or patients themselves would have provided. Most caregivers were unable to determine the CHADS-2 score of the patient they cared for, which would have been a good indicator of severity. Still, the majority of caregivers were able to identify type of AF and most other characteristics. For the identification of comorbidities, a trade-off was made between specificity of disease categories and caregivers' ability to respond. More specific disease categories would be desired to quantify the impact of specific indications (eg, congestive heart failure) on caregivers, but caregivers might encounter difficulties in identifying patient's comorbidities on that level of detail. The active involvement of patients or treating physicians would have been needed to ensure the quality of responses.

More than 90% of the patient population had comorbidities. Given the indication and the relatively high age of patients this is not surprising, but it does complicate the interpretation of the results. The total hours of care provided are not related to AF only, and subjective burden, CarerQol utility, and informal care costs are affected by comorbidities as well; the descriptive statistics on caregiver burden and informal care costs therefore also reflect the burden related to comorbid diseases. However, in practice, it would be impossible to single out caregiver tasks and burden according to AF or other diagnoses, hence in the survey such a distinction was not asked for. The impact of other factors can only be controlled for once data are collected. In the current study, regression analyses showed the significant contribution of various comorbidities on absolute and subjective burden.

Selection bias cannot be ruled out, but it is unclear how this might have affected results; on one hand, more burdened caregivers might be inclined more to express their situation, but on the other hand might also have had limited time or energy left to participate in the study. Assessing caregiver burden alongside future clinical trials is necessary to reduce potential selection bias.

Implications

Most patients with AF who receive informal care are elderly patients who have comorbidities such as diabetes, respiratory diseases, and other cardiovascular diseases. Societal costs of informal care of AF are shown to be substantial, demonstrating that the elderly patient is often an ecosystem rather than a single affected unit and that a less favorable clinical outcome will affect both the patient with AF and the caregiver. Hence, when performing an economic evaluation from a societal perspective, not only medical costs but also inclusion of informal care costs is pivotal. When interventions are expected to affect the need for informal care, this would also translate into societal cost savings.

The current study further showed that caregivers of patients with AF provided a large amount of informal care. Although the majority of caregivers indicated they receive fulfillment from providing informal care, caregiver quality of life was shown to be lower than in many other indications. Caregivers exposed to such demanding caregiving situations face a risk of negative effects on their own health, becoming overburdened and eventually no

longer being able to provide necessary informal care. Recognition of caregiver burden and providing assistance to caregivers might help to prevent negative health effects in caregivers and to ensure that caregivers remain motivated in performing their important caregiving tasks. Such assistance might come in the form of respite care (ie, giving caregivers some time off from providing informal care). This would be particularly useful for caregivers who face a high burden of caregiving and do not retrieve fulfillment from providing care.³⁸ Attention for caregiver burden and policies to deal with caregiver burden are especially relevant in light of the increasing prevalence of AF in the coming years.

Conclusions

This study shows that caregivers for patients with AF provided a considerable amount of informal care. Providing care can be burdensome to caregivers but can also provide fulfillment to them. Both absolute burden and subjective burden were similar among the UK, Italy, and Germany. Informal care also results in societal costs due to time costs of caregivers and absence from work due to health issues resulting from informal care.

Supplemental Material

Supplementary data associated with this article can be found in the online version at <https://doi.org/10.1016/j.jval.2020.09.011>.

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