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A Review of the Cost of Atrial Fibrillation

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A B S T R A C T

Objectives: To systematically review and synthesize the literature on the costs of atrial fibrillation (AF) with attention to study design and costing methods, geography, and intervention approaches. **Methods:** A systematic search for previously published studies reporting the costs for AF patients was conducted. Data were analyzed in three steps: first by evaluating overall system costs; second by evaluating the relative contribution of specific cost components; and third by examining variations across study designs, across primary treatment approach, and by geography. Finally, a specific review of the treatment costs associated with anticoagulation treatment was examined given the clinical importance and attention given to these costs in the literature. **Results:** The literature search resulted in 115 articles. On review of the abstracts or full text of these articles, 21 articles met all study criteria and reported on health system AF-related direct costs. A further six articles focused exclusively on anticoagulation costs for patients with AF. The overall average annual system cost across 27 estimates obtained from the literature was $5450 (SD = $3624) in 2010 Canadian dollars and ranged from a low of $1,632 to a high of $21,099. About one-third of these costs could be attributed to anticoagulation management. The largest cost component was acute care, followed by outpatient and physician and then medication-related costs. **Conclusion:** AF-related medical costs are high, reflecting resource-intensive and long-term treatments including anticoagulation treatment. These costs, accompanied with increasing prevalence, justify increased attention to the management of patients with AF. Future studies of AF cost should ensure a broad assessment of the incremental direct medical and societal cost associated with this diagnosis.

Keywords: atrial fibrillation, cost analysis, cost of illness, direct cost, systematic review.

Introduction

Atrial fibrillation (AF) has been described as a silent epidemic [1]. Silent because although patients with AF experience significant morbidity, many patients with AF are asymptomatic when first detected, and an epidemic because population-based studies have highlighted a rapid rise in the incidence of this condition with forecasts of 6 million Americans living with this condition by 2050 [2]. Because AF is directly correlated to advancing age [3,4], aging populations and increases in the prevalence of other known predisposing risk factors, such as hypertension [5], are contributing to increases in AF prevalence internationally, raising the concern of a major public health crisis and crippling health-care costs [6,7].

The economic burden of AF is nontrivial. Cost-of-illness studies have identified annual AF-related costs in 2005 of $6.65 billion in the United States and £459 million in the United Kingdom [8,9], constituting a considerable proportion of a comparable estimate for all cardiovascular disease (e.g., $45.5 billion in 2005 in the United States [10]). It is important to provide a broad-based assessment of economic cost associated with AF and to gain an understanding of its main drivers. Many studies have examined costs by using different sources of data and different methodologies. For example, cost-effectiveness studies have compared AF therapies (pharmaceutical rate or rhythm management and surgical ablation). While occasionally using local prices, these latter studies often use economic models populated with utilization data from a particular study in the literature, sometimes with insufficient attention to the representativeness of the assumptions. Others have used surveys, administrative data, or patient-reported data to estimate care costs. A systematic review of these costing studies would be particularly useful to payers, decision makers, and researchers to understand both the economic burden of AF and also how these costs vary across treatment modalities to identify potential economic impacts resulting from changes in practice. The objective of the present research was therefore to systematically review and synthesize the literature on the costs of AF. While such reviews have been conducted for diseases such as dementia [11], diabetes [12], and cardiovascular disease [13], there is no synthesis for AF.

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Methods

Literature review

A systematic search for previously published articles reporting the costs for patients with AF was conducted from the following databases: OVID (MEDLINE), EMBASE, and the Cochrane Library using "atrial fibrillation" subject heading and then "health care cost" or "cost" or "economic" or "economics" as subject headings. We limited the search to English language articles published between 1996 and February 2010, updated to January 2011. Articles were excluded if the cost data covered a period of less than 1 year, if the article did not provide any new cost information (e.g., summary of results already reported elsewhere), or if costs were not reported specifically for patients with AF. To enable comparable costs and an analysis of cost drivers, studies had to include costs for acute care and costs for at least one of medication, outpatient, or physician treatment. To ensure that comparable data could be extracted from studies with a variety of different study designs, a final inclusion criterion required that cost data be reported in a way that could be expressed as a per-person per-year basis. Abstracts were screened by one author for possible inclusion or exclusion before retrieving full-text versions of the publications. Once retrieved, the full text was scanned to ensure that it met inclusion criteria. References were further examined to identify additional relevant articles.

Data abstraction

Using a standardized data abstraction form, data extracted from each eligible article included the country, currency and year of cost data, study design, number of patients, primary treatment intervention, total costs, direct and indirect costs, breakdown of cost components where available, and data sources.

Standardization of cost data

Most study costs were reported as per-person per-year costs, and this was adopted as the standard by which study data were compared. Where necessary, cost data reported in each article were converted to reflect average costs per-patient per-year during the study period. These annualized costs were then converted to 2010 Canadian dollars first by converting the currency to Canadian dollars in the period of study by using the purchasing power parity for the year of cost data [14] and then by converting costs to 2010 by using the Canadian health-care services price index [15]. Annual costs were available in all except seven articles where only multiyear cost data were available (e.g., a total cost of $25,623 over a lifetime of 4.6 years [16]). In the latter cases, the present value cost was divided by an annuity factor over the same time period and adjusted by using the discount rate specific to each study.

Analysis

Data were analyzed in three steps: first by evaluating overall system costs; second by evaluating the relative contribution of specific cost components (i.e., acute and other institutional settings, physician, laboratory, medications, other); and third by examining variations across study designs, across primary treatment approach (rhythm, rate, or surgical ablation procedures), and by geography. Finally, a specific review of the treatment costs associated with anticoagulation treatment was examined given the clinical importance and attention given to these costs in the literature.

Results

The literature search resulted in 115 articles (including six added with the update to 2011). On review of the abstracts or full text of these articles, 28 were excluded because they did not report cost data and 33 were excluded because they focused on costs over a period of less than 1 year or did not include physician, outpatient, or medication costs. The majority of the latter articles examined costs associated with a single hospital stay. A further 18 articles were excluded because they summarized data that were already reported in another study (typically by the same author), 9 were excluded because per-patient per-year costs could not be measured by using the reported data (most commonly because the data were reported as part of a cost-utility study). Twenty-one articles met all study criteria and reported on health system AF-related costs. A further six articles identified in the review focused exclusively on anticoagulation costs for patients with AF, four providing full system costs and two focusing primarily on monitoring costs.

System-wide cost studies

Full-year system costs were available from 21 articles inclusive of hospital, physician, and drug costs. One article reported cost estimates for five different countries, one reported estimates for two countries, and another provided estimates for both a multicenter and a single-center cohort. Eight other articles were cost-effectiveness studies and provided cost estimates for more than one treatment strategy. Four articles compared rate and rhythm strategies while six offered comparisons between pharmaceutical management and ablation procedures. In total, cost estimates for pharmaceutical rhythm or rate management treatment strategies were either combined or not separately identified in 15 articles. To enable comparisons across all estimates, a combined "study" cost (for all treatment strategies) was calculated by using the total reported average cost in 9 instances. We were therefore able to extract a total of 27 different combined "study cost" estimates of the health system cost associated with treating patients with AF over the course of 1 year of treatment and a total of 16 treatment-specific estimates including five rhythm-specific, four rate-specific, and seven ablation-specific cost estimates.

Cost summary

Table 1 presents annualized costs grouped by study design and ordered by year of reported cost data. Costs are AF-related except where noted to be either indeterminate or represent all direct medical costs for patients with AF. The overall average annual system cost across the 27 (combined-treatment) study-cost estimates obtained from the literature shown in Table 1 was $5450 (SD = $3624) in 2010 Canadian dollars. The median was $4979 (interquartile range = $3413–$6371), suggesting a small positive skew among cost estimates. While these costs are substantial, they represent only about one-quarter of the entire health system costs for patients with AF. Three articles estimated the entire system cost for all care for patients with AF. Costs for all medical treatment (AF and non-AF related) were reported to be $25,715 in a privately insured population [18] and $39,877 for Medicare patients in the United States [17] while annual individual costs for stroke patients with AF was estimated at $20,023 in Germany [24] (all estimates reported in 2010 Canadian dollars).

A review of studies by methodological approach

Methodological differences across studies were a primary determinant of the types of costs included and therefore the final cost estimates. Most studies employed the perspective of the health system payer and included only direct medical costs, while a few