Comparison of the Impact of the Atrial Fibrillation Follow-Up Investigation of Rhythm Management Trial on Prescribing Patterns: A Time-Series Analysis

Niteesh K Choudhry, Brandon Zagorski, Jerry Avorn, Raisa Levin, Kathy Sykora, Andreas Laupacis, and Muhammad Mamdani

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia and affects more than 5% of people over the age of 65 years.[1] The symptoms of AF, which are primarily due to poorly controlled or irregular ventricular heart rate, have traditionally been managed with pharmacologic treatments that attempt to restore and maintain sinus rhythm (rhythm control).[2] While rhythm control leads to the reestablishment of the atrial contribution to cardiac output and improves exercise capacity, antiarrhythmic medications have adverse effects and are costly.[3,4] In contrast, drugs that reduce the ventricular response rate of AF (rate control) have a more favorable adverse effect profile and achieve more reliable control of the ventricular rate; however, AF is not corrected.[4]

The AFFIRM (Atrial Fibrillation Follow-Up Investigation of Rhythm Management) trial[5] and a series of smaller randomized trials[6-9] have demonstrated that both strategies result in similar survival rates and quality of life. Because rhythm control was associated with a greater risk of adverse events and noncardiovascular death,[10] rate control is now the recommended strategy for the management of most high-risk AF patients (ie, those who are older than 65 and/or have risk factors for AF-associated stroke).[3,11,12]

BACKGROUND: The AFFIRM (Atrial Fibrillation Follow-Up Investigation of Rhythm Management) trial demonstrated that rate control and rhythm control strategies result in similar survival and quality of life for patients with atrial fibrillation (AF). Because of superior safety and lower cost, rate control is now the recommended strategy for the management of most elderly, high-risk AF patients.

OBJECTIVE: To determine the extent to which the AFFIRM trial results have been adopted into actual practice.

METHODS: We conducted a time-series analysis of 3 population-based cohorts of patients with AF who were 66 years of age or older in Pennsylvania and Ontario. We stratified patients in Ontario by socioeconomic status (SES) and examined changes in quarterly prescription rates for rate control and rhythm controlling medications as well as cardioversion procedures before and after publication of the AFFIRM trial.

RESULTS: The publication of the AFFIRM trial resulted in statistically significant reductions in the use of rhythm controlling medications in all 3 cohorts (p < 0.01). The magnitude of these changes in the non-low SES Canadian cohort was approximately 1% per quarter and was greater than the magnitude observed in the other cohorts (p < 0.001). The use of cardioversion procedures also decreased in all study regions (p < 0.01). In contrast, AFFIRM publication was also associated with a small increase in the use of rate controlling medications in Canada (p < 0.01) but not in the US (p = 0.23).

CONCLUSIONS: Publication of the AFFIRM trial resulted in small but statistically significant changes in the care of patients with AF.

KEY WORDS: atrial fibrillation, practice patterns, prescribing.

Author information provided at the end of the text.

We assessed the extent to which the AFFIRM trial results have been adopted into actual practice, using data from the US and Canada. Because many patients are treated with both rate and rhythm control strategies, our primary interest was in evaluating the impact of the AFFIRM trial on the use of rhythm control medications and cardioversion procedures. Secondarily, we determined whether the

impact of the AFFIRM trial differed by country and patient socioeconomic status (SES).

Methods

SETTING AND DESIGN

We performed a time-series analysis of elderly AF patients (aged ≥66 y) from January 1, 1998, to December 31, 2004, using population-based cohorts in the US and Canada. The US cohort consisted of Medicare recipients enrolled in Pennsylvania's Pharmaceutical Assistance Contract for the Elderly (PACE) program.[13] This program provides comprehensive prescription drug coverage for a large population of the state's low-income elderly patients who are not indigent enough to qualify for Medicaid. In 2003, the annual income eligibility for PACE was $14,000 or less for single persons and $17,200 or less for married persons. The eligibility criteria have been quite stable over time, although they do change slightly from year to year to reflect cost-of-living increases. We linked the pharmaceutical claims data from PACE with complete paid claims data (Medicare Parts A and B) describing all clinical encounters for these individuals, including all recorded diagnoses. The data were assembled into a relational database consisting of information on all filled prescriptions, procedures, inpatient and outpatient physician encounters, hospitalizations, long-term care admissions, and deaths for the patients in our cohort. These databases have been used extensively for other drug policy evaluations.[14,15] There is minimal miscoding of drug information, and misclassification of relevant ICD-9 diagnoses is modest.[16-19] All traceable personal identifiers were removed prior to analysis to protect patient confidentiality.

Our Canadian cohort was drawn from Ontario. All Ontario residents have universal, publicly funded health insurance for hospital care and physician services, and residents aged 65 years and older also have prescription drug coverage for drugs listed in the provincial formulary. Hospital discharge data from the Canadian Institute of Health Information Discharge Abstract Database, pharmacy claims from the Ontario Drug Benefit Program database, physician service claims from the Ontario Health Insurance Plan database, and vital statistics from the Ontario Registered Persons database were linked anonymously using encrypted individual health card numbers to create a relational database. Less than 2% of the basic information on patients is missing in these databases,[20] which have been used extensively to study other population-based health outcomes.[21-24]

To allow for comparability between our US and Canadian cohorts, we divided the Ontario cohort into low and high SES. In 2003, low SES in Ontario was defined as annual income of less than $16,018 (Canadian; US $12,014) for single residents and less than $24,175 ($18,132) per couple based on the threshold used for patients to obtain reductions in medication copayments and deductibles.

This study was approved by the ethics review boards of Brigham and Women's Hospital, Boston, and Sunnybrook and Women's College Health Sciences Centre, Toronto.

COHORT DEFINITION

As in prior AF studies conducted by our research team,[25,26] we identified eligible patients by using hospital discharge abstracts (ICD-9 code 427.3). Validation studies have demonstrated that ICD codes have a specificity of 99% and positive predictive value of 97% for the diagnosis of AF.[27,28]

OUTCOMES

We divided each year of the study period into four 3-month quarters for a total of 28 consecutive intervals. During each interval, we identified every prescription for rhythm control agents (amiodarone, dofetelide, disopyramide, flecainide, moricizine, procainamide, propafenone, quinidine, or sotalol), rate control agents (β-blockers, calcium-channel blockers, or digoxin), and cardioversion procedures.

We assessed rates of rhythm control and rate control drug prescriptions and cardioversions during each quarter among patients who had been hospitalized with AF within the year preceding the start of a given 3-month interval.[29] Although our US and Canadian cohorts were of different sizes, the use of rates (ie, per 100 AF pts.) allowed for meaningful comparisons between cohorts and over time. Further, our sampling strategy made it possible to evaluate trends in prescribing and service utilization among a series of consecutive cohorts of recently hospitalized patients with AF. We also constructed a composite measure of AFFIRM concordant care, defined as the proportion of patients receiving rate control medications minus the proportion of those receiving rhythm control medications or undergoing cardioversion in a given quarter. This measure was intended to assess overall changes in practice from the AFFIRM trial in each of the cohorts that we evaluated (ie, at the system level).

PATIENT COMORBIDITIES

We used hospital discharge abstracts, physician service claims, and prescription drug claims during the year prior to cohort entry to identify the following comorbidities: ischemic stroke, congestive heart failure, hypertension, diabetes, coronary artery disease, and warfarin use. We also defined the number of hospital admissions and number of prescription medications in the preceding year as additional measures of patient comorbidity.[30]

STATISTICAL ANALYSIS

To evaluate whether the characteristics of the patients in our cohorts changed over time, we compared cohort members in representative pre- (ie, January–March 2001) and post- (ie, January–March 2003) AFFIRM study quarters.

We assessed the effects of the AFFIRM trial publication using interventional autoregressive integrated moving-average (ARIMA) models.[29,31] In our primary analysis, we considered the trial publication date to be July 3, 2002, when the abstract of the AFFIRM trial presented at the Annual Scientific Session of the American College of Cardiology first appeared in the *Journal of the American College of Cardiology*.[32] We also repeated our analysis based on the date that the AFFIRM trial was published in the *New England Journal of Medicine* (December 5, 2002).[5] Because our results were unchanged when this date was used, we present only one set of analyses below.

We assessed the effect of trial publication by adding an intervention parameter, incorporated by means of a ramp function, into our interventional ARIMA model, and examining the statistical significance of the β parameter estimate corresponding to the intervention parameter. Statistical significance was defined as p values (2-sided) less than 0.05. To assess the delayed effect of the AFFIRM trial publication, we used ARIMA models to forecast expected prescribing and utilization rates with 95% confidence intervals and compared these with actual utilization estimates. Separate models were constructed to evaluate trends among patients in Pennsylvania, low SES Ontario residents, and non-low SES Ontario residents.

Most time-series methods require the mean and variance of the data to remain the same at all time points; if this requirement is met, the data are considered stationary. This property was assessed using the autocorrelation functions and the augmented Dickey-Fuller test. Autocorrelation, partial autocorrelation, and inverse autocorrelation functions were assessed for model parameter appropriateness and seasonality. The presence of "white noise" was assessed by examining the autocorrelations at various lags with use of the Ljung-Box χ^2 statistic. All p values were 2-sided.

To assess whether the magnitude of changes in practice patterns resulting from the AFFIRM trial differed between cohorts, we created segmented linear regression models that included parameters for baseline treatment patterns, the AFFIRM trial publication, and treatment trends after the trial was published. We determined whether AFFIRM publication resulted in greater or smaller changes in treatment patterns for particular cohorts by examining the statistical significance of the interaction terms between cohort membership and level and slope parameters corresponding to the post-AFFIRM period.

All analyses were conducted with the SAS statistical software program, version 8.2 (SAS Institute, Cary, NC).

Results

The prevalence of hospitalized patients with AF in Ontario remained constant at 1.5% throughout the study period (ranging from 22,272 pts. per quarter in January 1998 to 24,534 per quarter at the end of 2004). In contrast, the prevalence of AF in Pennsylvania gradually increased over time, from 6.1% to 7.2%. Table 1 presents patients' base-

Characteristics	Pennsylvania		Ontario (low SES)		Ontario (non-low SES)		AFFIRM Trial Participants[4] (n = 4,060)
	Before AFFIRM[a] (n = 1,416)	After AFFIRM[b] (n = 1,368)	Before AFFIRM (n = 8,642)	After AFFIRM (n = 8,439)	Before AFFIRM (n = 10,463)	After AFFIRM (n = 9,853)	
Age, median years (IQR)	82 (76–88)	82 (76–88)	80 (75–86)	81 (75–86)	77 (72–82)	78 (73–83)	70 ± 9[c]
Female, % (n)	78.3 (1108)	77.5 (1074)	66.6 (5765)	65.9 (5559)	44.3 (7752)	44.6 (8532)	39.3 (1594)
Number of hospitalizations in year prior to cohort entry, mean ± SD	2.2 ± 1.6	2.1 ± 1.7	1.8 ± 1.3	1.8 ± 1.4	1.7 ± 1.3	1.7 ± 1.2	NR
Coronary artery disease, %	60.0	59.7	45.0	42.5	44.2	41.4	26.1
Diabetes, %	38.4	40.0	24.4	26.2	20.9	22.0	NR
Hypertension, %	85.7	90.1	50.4	53.6	48.5	51.6	50.8
Congestive heart failure, %	55.8	52.2	45.0	42.5	31.7	31.1	23.1
Ischemic stroke, %	13.7	16.0	7.4	7.5	6.5	6.3	NR
Warfarin use, %	35.5	34.4	59.2	61.7	62.7	66.0	NR

Table 1. Baseline Characteristics

IQR = interquartile range; NR = not reported.
[a]Based on patients in the cohort in the first quarter of 2001.
[b]Based on patients in the cohort in the first quarter of 2003.
[c]Mean ± SD.

line characteristics. Members of our study cohorts were 9–13 years older, more likely to be women, and more likely to have coronary artery disease and congestive heart failure compared with patients enrolled in the AFFIRM trial (Table 1). While patients treated before and after publication of the AFFIRM trial appeared to be similar, there were differences between the 3 cohorts. Compared with all study patients in Ontario, patients in Pennsylvania were older, more likely to be female, had greater numbers of comorbidities, and were less likely to use warfarin. Patients in Pennsylvania were more similar to the low SES than the non-low SES Ontario cohort.

RATES OF MEDICATION AND PROCEDURE USE

Use of rhythm controlling drugs was substantially higher in Ontario than in Pennsylvania and was relatively constant until early 2002 (Figure 1). In the 2 years prior to AFFIRM publication, an average of 20.8%, 18.1%, and 11.9% of patients in the non-low SES Ontario, low SES Ontario, and Pennsylvania cohorts, respectively, received rhythm controlling medications. In the 2 years after AFFIRM publication, the corresponding average prescription

rates were 18.6%, 16.3%, and 13.0%. Adjusting for preexisting prescribing trends, the publication of AFFIRM was associated with significant reductions from the expected trends in use of these drugs in all cohorts (p < 0.001 for change in slope in the non-low SES Ontario cohort; p < 0.001 in the low SES Ontario cohort; p = 0.004 in the Pennsylvania cohort). The magnitude of these changes in the non-low SES Canadian cohort was approximately 1% per quarter and was greater than the magnitude observed in both the low SES Ontario and the Pennsylvania cohorts (p < 0.001).

Rates of cardioversion procedures were also higher in Ontario than in Pennsylvania (Figure 2). In the 2 years prior to AFFIRM publication, an average of 1.1%, 0.6%, and 0.5% of patients in the non-low SES Ontario, low SES Ontario, and Pennsylvania cohorts, respectively, underwent cardioversion. In the 2 years after AFFIRM publication, the corresponding average prescription rates were 0.8%, 0.5%, and 0.4%, respectively. Adjusting for preexisting prescribing trends, the publication of AFFIRM was associated with reductions in procedure use in all cohorts (p < 0.001 for change in slope in the non-low SES Ontario cohort, in the low SES Ontario cohort, and in the Pennsyl-
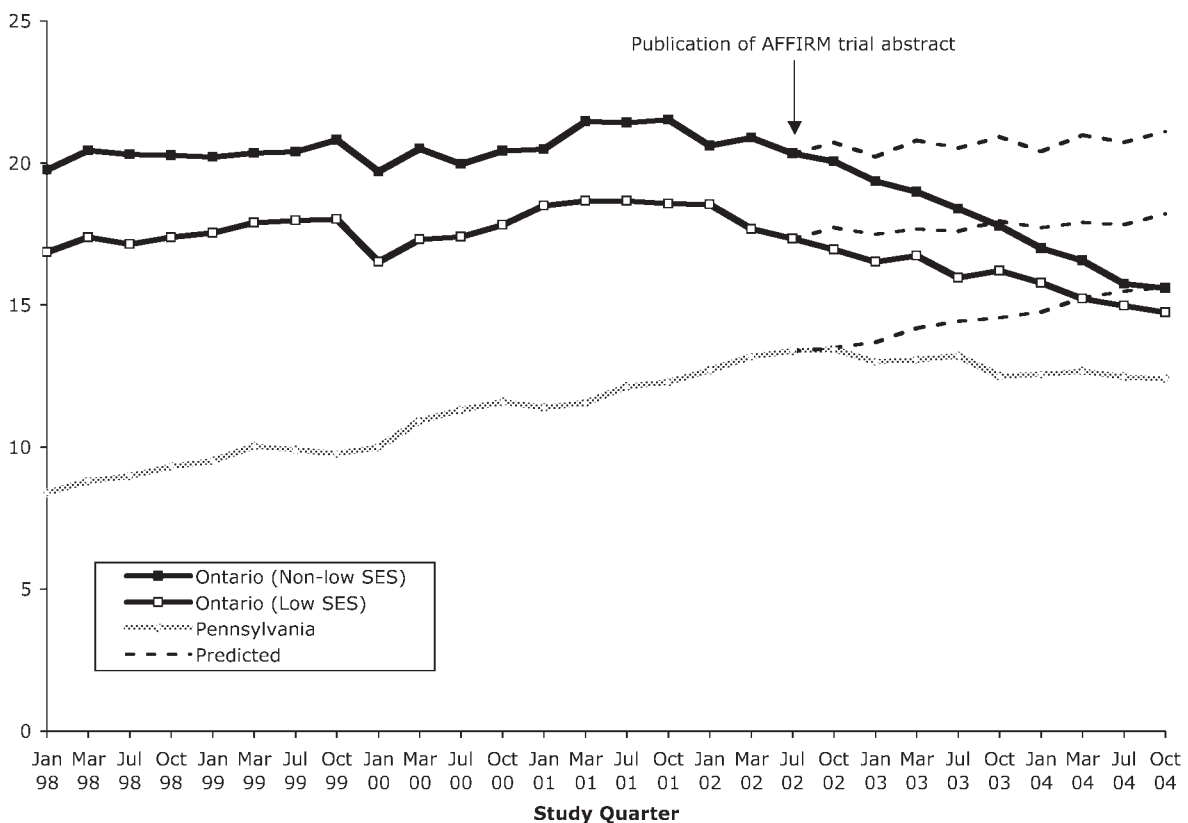
Figure 1. Trends in use of rhythm controlling medications in Ontario and Pennsylvania before and after publication of the AFFIRM trial. Each point represents the observed rate of rhythm controlling medication use per 100 atrial fibrillation patients in each study quarter for the 3 study cohorts. The solid lines represent the observed trends in rhythm controlling medication use for each cohort; the dashed lines depict the predicted rates beginning from the time that the AFFIRM trial abstract was published (arrow). AFFIRM = Atrial Fibrillation Follow-Up Investigation of Rhythm Management; SES = socioeconomic status.

vania cohort). The magnitude of the changes in rates was not significantly different between the cohorts (non-low SES Ontario vs Pennsylvania, p = 0.61; low SES Ontario vs Pennsylvania, p = 0.54; non-low vs low SES Ontario cohorts, p = 0.9).

The use of rate controlling medications was substantially higher in both Ontario cohorts than in Pennsylvania and was relatively constant until mid-2002 (Figure 3). In the 2 years prior to AFFIRM publication, an average of 61.9%, 65.6%, and 47.7% of patients in the non-low SES Ontario, low SES Ontario, and Pennsylvania cohorts, respectively, received rate controlling medications. In the 2 years after AFFIRM publication, the corresponding average prescription rates were 64.1%, 67.9%, and 45.9%. Adjusting for pre-existing prescribing trends, publication of AFFIRM was associated with significant changes in the use of rate controlling medications in both Ontario cohorts (p = 0.001 for change in slope for non-low SES; p = 0.003 for low SES) but not in Pennsylvania (p = 0.23 for change in trend). As a result, the magnitude of these changes was greater in both Canadian cohorts than in Pennsylvania (p < 0.001).

Overall, rates of AFFIRM concordant care were higher in Ontario than in Pennsylvania (Figure 4) and changed significantly in both Ontario cohorts (p = 0.001 for change in slope for non-low SES; p = 0.002 for low SES) but not in Pennsylvania (p = 0.51 for change in trend). The magnitude of these changes was significantly larger in the non-low SES Ontario cohort than in the other cohorts (p < 0.001).

Discussion

We evaluated the adoption of clinical trial evidence concerning the management of AF in routine practice in a US state and a Canadian province and among patients of low and higher SES. Publication of the AFFIRM trial was associated with statistically significant reductions in use of rhythm control strategies in all of our cohorts, as well as increases in the use of rate controlling medications in Canada, but not in the US. The magnitude of these changes was greatest among the highest SES cohort.

Many previous studies have evaluated the adoption of clinical trial evidence into practice.[29,33-35] In contrast to several of these analyses, the magnitude of the changes we observed was relatively small. This may be because practice innovations involving conceptual shifts, such as the
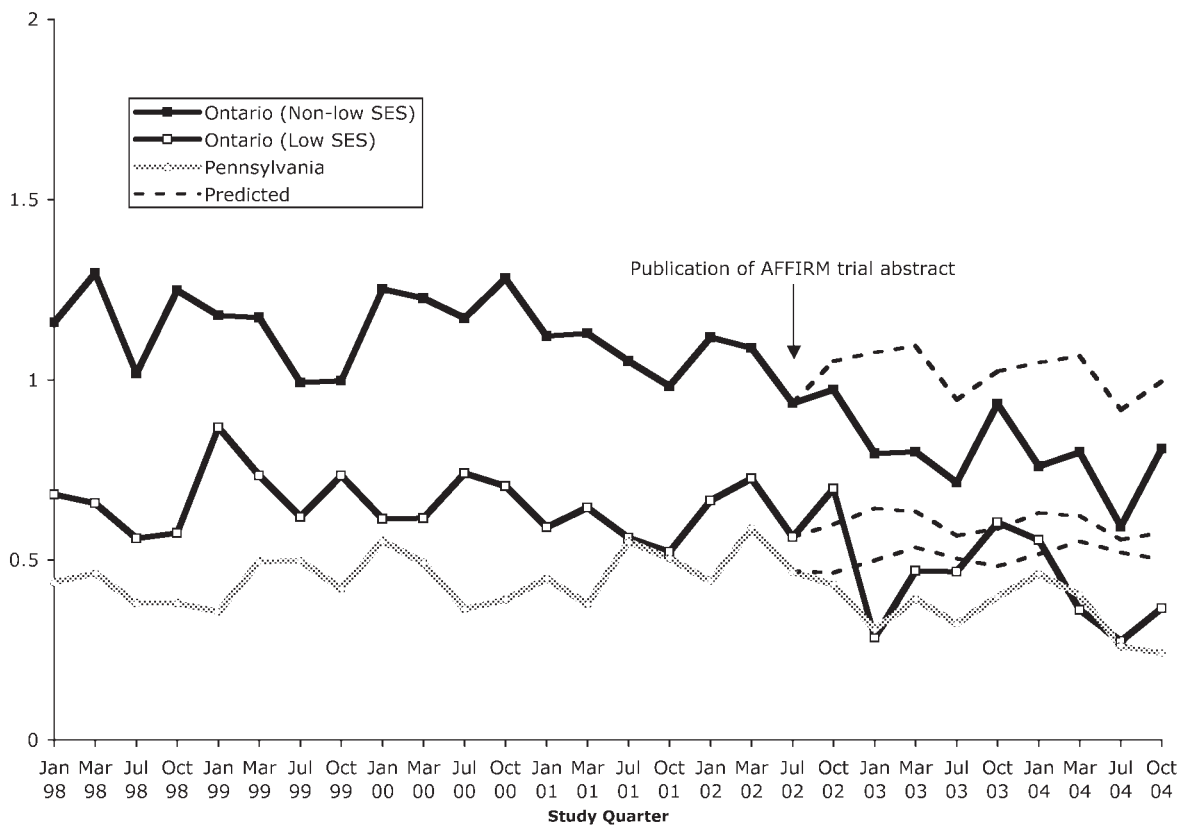
Figure 2. Trends in use of cardioversion in Ontario and Pennsylvania before and after publication of the AFFIRM trial. Each point represents the observed rate of cardioversion use per 100 atrial fibrillation patients in each study quarter for the 3 study cohorts. The solid lines represent the observed trends in cardioversion use for each cohort; the dashed lines depict the predicted rates beginning from the time the AFFIRM trial abstract was published (arrow). AFFIRM = Atrial Fibrillation Follow-Up Investigation of Rhythm Management; SES = socioeconomic status.

use of less aggressive surgical therapy for early-stage breast cancer, are harder to incorporate into the practice of physicians than are innovations that add a procedure or technique consistent with physicians' preexisting knowledge.[36] Accordingly, these research findings may not have been widely adopted because the symptoms of AF have traditionally been managed with rhythm as opposed to rate control[2] and the results of the AFFIRM trial are at odds with this practice.

The small magnitude of the practice pattern changes that we observed means that it is unlikely that this important trial achieved its potential impact on the quality of care for patients with AF. As such, our results reinforce the need for greater adoption of the AFFIRM trial findings into actual practice. Few quality improvement interventions for improving prescribing for patients with AF have been reported, and many of the existing studies focus on warfarin prescribing and have important methodological limitations.[37-39] The vast literature on improving drug prescribing suggests that the strategies that are most likely to be effective are those that employ "active" knowledge translation techniques, such as academic detailing, to provide physicians with patient-specific data as to whether individual patients would benefit from various therapeutic interventions.[40,41] Further, because the prevalence of AF is increasing as the population ages[1] and because rate control is more cost-effective than rhythm control,[3] such interventions may also reduce the economic burden that this disease imposes. Therefore, efforts to improve prescribing in AF should rely on these methods rather than on the untailored messages that most physicians receive through traditional continuing medical education activities.

We observed differences in the rates of use and adoption of evidence between Ontario patients of different SES. Disparities in care based on SES have been previously documented in Canada, even though all patients have access to universal publicly funded health insurance[42,43]; such disparities are well recognized in the US.[44] The higher use of rhythm control strategies and the lower use of rate control strategies among higher SES patients in our study is consistent with these previous reports. Moreover, the greater adoption of the AFFIRM trial results into the care of the more affluent patients in our study supports recent observations that patients of higher SES are also more likely to receive new therapies of demonstrated efficacy.[45]

The use of both rhythm and rate control strategies and the magnitude of change in response to the publication of AFFIRM were greater in Canada than in the US. This ob-
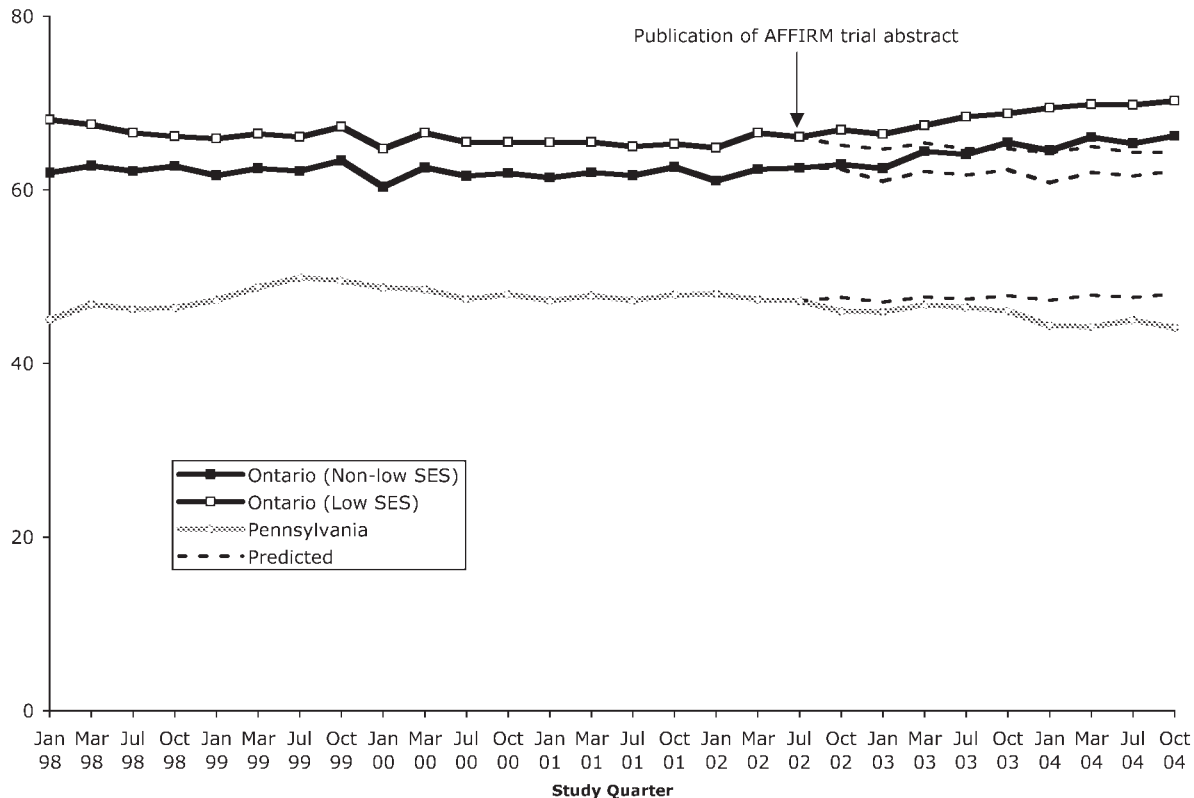
Figure 3. Trends in use of rate controlling medications in Ontario and Pennsylvania before and after publication of the AFFIRM trial. Each point represents the observed rate of rate controlling medication use per 100 atrial fibrillation patients in each study quarter for the 3 study cohorts. The solid lines represent the observed trends in rate controlling medication use for each cohort; the dashed lines depict the predicted rates beginning from the time the AFFIRM trial abstract was published (arrow). AFFIRM = Atrial Fibrillation Follow-Up Investigation of Rhythm Management; SES = socioeconomic status.

servation persisted even when comparing our US cohort, which consisted of lower middle-income patients enrolled in a state pharmacy assistance program, with comparable low SES Ontario patients. Previous studies have demonstrated greater use and adoption rates of evidence-based cardiovascular therapies, such as β-blockers and angiotensin-converting enzyme inhibitors, by Canadian physicians.[46,47] There are several possible explanations for these differences. Our results may reflect differences in the patients in our cohorts that may have made it less likely for US patients to be prescribed treatment. For example, because the US cohort was slightly older and had more comorbidities, they may have been less tolerant of rate controlling medication. In contrast, higher rates of coronary artery disease and congestive heart failure among the US patients should presumably have led to higher, not lower, rates of β-blocker, calcium-channel blocker, and digoxin prescribing, but this was not observed. Alternatively, while overall pharmaceutical company promotional spending, in particular that which is directed at physicians, is generally substantially higher in the US than in Canada, per-physician rates of promotional spending are sometimes higher in Canada. These differences have been associated with

differences in prescribing patterns between the 2 countries. For example, Majumdar et al.[48] studied rates of ramipril use after the publication of the HOPE (Heart Outcomes and Prevention Evaluation) trial and found that higher spending on ramipril promotional (detailing) visits to physicians in Canada was associated with greater use of this drug.

There are several significant strengths to our analysis. Using large, population-based cohorts of patients with AF should provide an accurate reflection of overall patterns of medication use in these jurisdictions. Our research design allowed us to examine the impact of both SES and transnational factors on treatment patterns, which thereby increases the generalizability of our results. Using hospital records and other diagnostic information provides high-quality data about patient comorbidity.

Several limitations to our study must be acknowledged. First, because we relied on hospitalization records to identify patients with AF, our results may not be generalizable to healthier patients with AF. However, given the prevalence of AF and the likelihood that many elderly patients would have been hospitalized at some point during the study period, we believe that our results are applicable to
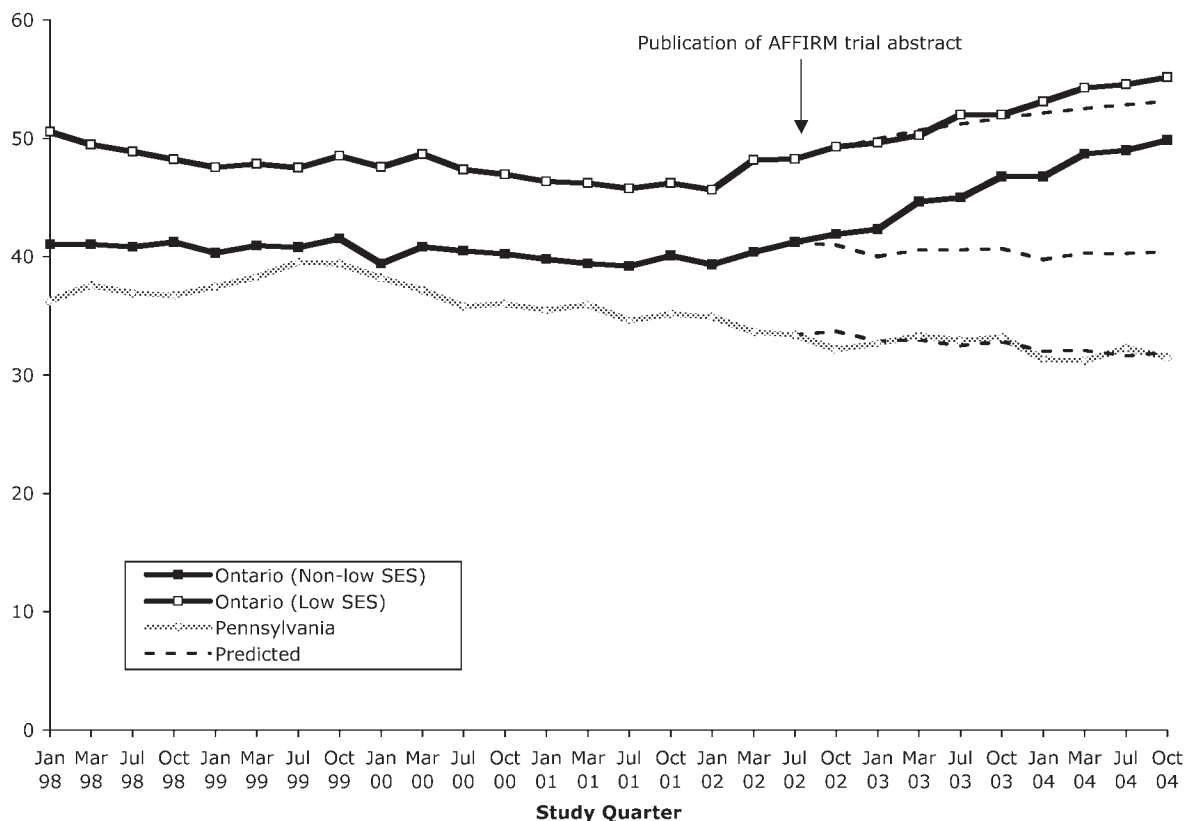

Figure 4. Trends in AFFIRM-concordant care in Ontario and Pennsylvania before and after publication of the AFFIRM trial. Each point represents the observed rate of AFFIRM-concordant care in each study quarter for the 3 study cohorts. AFFIRM-concordant care was defined as the proportion of patients receiving rate control medications minus the proportion of patients receiving rhythm control medications and cardioversion. The solid lines represent the observed trends in AFFIRM-concordant care for each cohort; the dashed lines depict the predicted rates beginning from the time the AFFIRM trial abstract was published (arrow). AFFIRM = Atrial Fibrillation Follow-Up Investigation of Rhythm Management; SES = socioeconomic status.

the majority of community-dwelling elderly patients with AF. Second, the patients in our cohorts were older and had more comorbid conditions compared with patients enrolled in the AFFIRM trial. As a result, the relative lack of adoption of this trial into practice may have been a reflection of appropriate clinical considerations for which we are unable to account. Third, it is impossible to differentiate patient nonadherence in filling a prescription from physician nonprescription in our data. Fourth, our US data source was restricted to individuals of low SES, as most other Medicare beneficiaries did not have public pharmacy coverage during the study period. As such, we were unable to make intercountry comparisons for more affluent patients with AF. Fifth, we cannot exclude the possibility that patients in our cohorts were using antiarrhythmics for ventricular arrhythmias or rate controlling medications for hypertension, coronary artery disease, or congestive heart failure. By using time-series analysis, these alternative indications would only bias our results if meaningful changes in the use of these drugs for these alternative indications occurred concurrently with the publication of the AFFIRM trial results. This is highly unlikely. Finally, because we used data from 2 different countries, there may have been minor differences in ICD coding systems.

In summary, our study demonstrates small but statistically significant changes in prescribing and procedure use following the publication of the AFFIRM trial. The small magnitude of the change in practice that we observed highlights the need for efforts to speed the translation of high-quality research evidence into clinical practice.

Conclusions

The publication of the AFFIRM trial resulted in statistically significant reductions in the use of rhythm controlling strategies in Ontario and Pennsylvania but only a small increase in the use of rate controlling medications in Ontario. The small magnitude of the observed changes reinforces the need to develop strategies to facilitate the translation of high-quality research data into actual clinical practice for patients with AF. While few quality improvement interventions for improving prescribing in AF patients have been reported, the general literature on improving drug prescribing suggests that the strategies that are most likely to be effective are those that employ active knowledge translation techniques to provide physicians with patient-specific data.

Niteesh K Choudhry MD PhD, Assistant Professor, Division of Pharmacoepidemiology and Pharmacoeconomics, Brigham and Women's Hospital, Harvard Medical School, Boston, MA

Brandon Zagorski MS, Analyst, The Institute for Clinical Evaluative Sciences, Toronto, Ontario, Canada

Jerry Avorn MD, Professor and Chief, Division of Pharmacoepidemiology and Pharmacoeconomics, Brigham and Women's Hospital, Harvard Medical School

Raisa Levin MS, Senior Programmer, Division of Pharmacoepidemiology and Pharmacoeconomics, Brigham and Women's Hospital, Harvard Medical School

Kathy Sykora MSc, Director, Programming and Biostatistics, The Institute for Clinical Evaluative Sciences

Andreas Laupacis MD MSc, Professor, Faculty of Medicine, University of Toronto; Executive Director, Li Ka Shing Knowledge Institute, St. Michael's Hospital, Toronto, Ontario

Muhammad Mamdani PharmD MA MPH, Associate Professor, Faculty of Medicine, Health Policy, Management and Evaluation and Pharmacy, University of Toronto; Director, Applied Health Research Centre, St. Michael's Hospital, Toronto

Reprints: Dr. Choudhry, Brigham and Women's Hospital, Harvard Medical School, 1620 Tremont St., Suite 3030, Boston, MA 02120, fax 617/232-8602, nchoudhry@partners.org

References

1. Go AS, Hylek EM, Phillips KA, et al. Prevalence of diagnosed atrial fibrillation in adults: national implications for rhythm management and stroke prevention: the anticoagulation and risk factors in atrial fibrillation (ATRIA) study. JAMA 2001;285:2370-5.
2. Falk RH. Atrial fibrillation. N Engl J Med 2001;344:1067-78.
3. Marshall DA, Levy AR, Vidaillet H, et al. Cost-effectiveness of rhythm versus rate control in atrial fibrillation. Ann Intern Med 2004;141:653-61. 141/9/653 [pii]
4. Waldo AL. Management of atrial fibrillation: the need for AFFIRMative action. AFFIRM investigators. Atrial Fibrillation Follow-up Investigation of Rhythm Management. Am J Cardiol 1999;84:698-700.
5. Wyse DG, Waldo AL, DiMarco JP, et al. A comparison of rate control and rhythm control in patients with atrial fibrillation. N Engl J Med 2002;347:1825-33.
6. Van Gelder IC, Hagens VE, Bosker HA, et al. A comparison of rate control and rhythm control in patients with recurrent persistent atrial fibrillation. N Engl J Med 2002;347:1834-40.
7. Carlsson J, Miketic S, Windeler J, et al. Randomized trial of rate-control versus rhythm-control in persistent atrial fibrillation: the Strategies of Treatment of Atrial Fibrillation (STAF) study. J Am Coll Cardiol 2003; 41:1690-6.
8. Hohnloser SH, Kuck KH, Lilienthal J. Rhythm or rate control in atrial fibrillation—Pharmacological Intervention in Atrial Fibrillation (PIAF): a randomised trial. Lancet 2000;356:1789-94.
9. Opolski G, Torbicki A, Kosior DA, et al. Rate control vs rhythm control in patients with nonvalvular persistent atrial fibrillation: the results of the Polish How to Treat Chronic Atrial Fibrillation (HOT CAFE) Study. Chest 2004;126:476-86.
10. Steinberg JS, Sadaniantz A, Kron J, et al. Analysis of cause-specific mortality in the atrial fibrillation follow-up investigation of rhythm management (AFFIRM) study. Circulation 2004;109:1973-80. 10.1161/01.cir.0000118472.77237.fa
11. Fuster V, Ryden 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:e257-354.
12. Snow V, Weiss KB, LeFevre M, et al. Management of newly detected atrial fibrillation: a clinical practice guideline from the American Academy of Family Physicians and the American College of Physicians. Ann Intern Med 2003;139:1009-17.
13. Pharmaceutical Assistance Contract for the Elderly Act. 62 P.S. 2901-2908. www.pacode.com/secure/data/006/006toc.html (accessed 2006 May 16).
14. Fischer MA, Avorn J. Economic implications of evidence-based prescribing for hypertension: can better care cost less? JAMA 2004;291:1850-6.

15. Solomon DH, Finkelstein JS, Katz JN, Mogun H, Avorn J. Underuse of osteoporosis medications in elderly patients with fractures. Am J Med 2003;115:398-400.

16. Fisher ES, Whaley FS, Krushat WM, et al. The accuracy of Medicare's hospital claims data: progress has been made, but problems remain. Am J Public Health 1992;82:243-8.

17. Fowles JB, Lawthers AG, Weiner JP, Garnick DW, Petrie DS, Palmer RH. Agreement between physicians' office records and Medicare Part B claims data. Health Care Financ Rev 1995;16:189-99.

18. Glynn RJ, Monane M, Gurwitz JH, Choodnovskiy I, Avorn J. Agreement between drug treatment data and a discharge diagnosis of diabetes mellitus in the elderly. Am J Epidemiol 1999;149:541-9.

19. Romano PS, Mark DH. Bias in the coding of hospital discharge data and its implications for quality assessment. Med Care 1994;32:81-90.

20. Williams JI, Young W. A summary of studies on the quality of health care adminstrative databases in Canada. In: Goel V, Williams JI, Anderson GM, eds. Patterns of health care in Ontario. The ICES Practice Atlas. Ottawa: Canadian Medical Association, 1996:339-45.

21. Juurlink DN, Mamdani M, Kopp A, Laupacis A, Redelmeier DA. Drug–drug interactions among elderly patients hospitalized for drug toxicity. JAMA 2003;289:1652-8.

22. Bell CM, Redelmeier DA. Mortality among patients admitted to hospitals on weekends as compared with weekdays. N Engl J Med 2001;345:663-8.

23. Mamdani MM, Tu K, van Walraven C, Austin PC, Naylor CD. Postmenopausal estrogen replacement therapy and increased rates of cholecystectomy and appendectomy. CMAJ 2000;162:1421-4.

24. Crighton EJ, Mamdani MM, Upshur RE. A population based time series analysis of asthma hospitalisations in Ontario, Canada: 1988 to 2000. BMC Health Serv Res 2001;1:7.

25. Choudhry NK, Soumerai SB, Normand SL, Ross-Degnan D, Laupacis A, Anderson GM. Warfarin prescribing in atrial fibrillation: the impact of physician, patient, and hospital characteristics. Am J Med 2006;119:607-15.

26. Choudhry NK, Anderson GM, Laupacis A, Ross-Degnan D, Normand SL, Soumerai SB. Impact of adverse events on prescribing warfarin in patients with atrial fibrillation: matched pair analysis. BMJ 2006;332:141-5.

27. Kokotailo RA, Hill MD. Coding of stroke and stroke risk factors using International Classification of Diseases, revisions 9 and 10. Stroke 2005;36:1776-81.

28. Frost L, Vestergaard P. Caffeine and risk of atrial fibrillation or flutter: the Danish Diet, Cancer, and Health Study. Am J Clin Nutr 2005;81: 578-82.

29. Juurlink DN, Mamdani MM, Lee DS, et al. Rates of hyperkalemia after publication of the Randomized Aldactone Evaluation Study. N Engl J Med 2004;351:543-51.

30. Schneeweiss S, Seeger JD, Maclure M, Wang PS, Avorn J, Glynn RJ. Performance of comorbidity scores to control for confounding in epidemiologic studies using claims data. Am J Epidemiol 2001;154:854-64. 10.1093/aje/154.9.854

31. Pindyck RS, Ruvinfeld DL. Econometric models and economic forecasts. Boston: Irwin/McGraw-Hill, 1998.

32. Williams ES, Miller JM. Results from late-breaking clinical trial sessions at the American College of Cardiology 51st Annual Scientific Session. J Am Coll Cardiol 2002;40:1-18.

33. Austin PC, Mamdani MM. Impact of the pravastatin or atorvastatin evaluation and infection therapy—Thrombolysis in Myocardial Infarction 22/Reversal of Atherosclerosis with Aggressive Lipid Lowering trials on trends in intensive versus moderate statin therapy in Ontario, Canada. Circulation 2005;112:1296-300.

34. Tu K, Mamdani MM, Jacka RM, Forde NJ, Rothwell DM, Tu JV. The striking effect of the Heart Outcomes Prevention Evaluation (HOPE) on ramipril prescribing in Ontario. CMAJ 2003;168:553-7.

35. Udell JA, Fischer MA, Brookhart MA, Solomon DH, Choudhry NK. Effect of the Women's Health Initiative on osteoporosis therapy and expenditure in Medicaid. J Bone Miner Res 2006;21:765-71.

36. Greer AL. The state of the art versus the state of the science. The diffusion of new medical technologies into practice. Int J Technol Assess Health Care 1988;4:5-26.

37. Jackson SL, Peterson GM, Vial JH. A community-based educational intervention to improve antithrombotic drug use in atrial fibrillation. Ann Pharmacother 2004;38:1794-9. Epub 28 Sept 2004. DOI 10.1345/aph.1E152

38. Dartnell JG, Allen B, McGrath KM, Moulds RF. Prescriber guidelines improve initiation of anticoagulation. Med J Aust 1995;162:70-3.

39. Gaughan GL, Dolan C, Wilk-Rivard E, et al. Improving management of atrial fibrillation and anticoagulation in a community hospital. Jt Comm J Qual Improv 2000;26:18-28.

40. Grimshaw JM, Shirran L, Thomas R, et al. Changing provider behavior: an overview of systematic reviews of interventions. Med Care 2001;39: 112-45.

41. Jamtvedt G, Young JM, Kristoffersen DT, O'Brien MA, Oxman AD. Audit and feedback: effects on professional practice and health care outcomes. Cochrane Database Syst Rev 2006:CD000259.

42. Alter DA, Chong A, Austin PC, et al. Socioeconomic status and mortality after acute myocardial infarction. Ann Intern Med 2006;144:82-93.

43. Alter DA, Naylor CD, Austin P, Tu JV. Effects of socioeconomic status on access to invasive cardiac procedures and on mortality after acute myocardial infarction. N Engl J Med 1999;341:1359-67.

44. Minkler M, Fuller-Thomson E, Guralnik JM. Gradient of disability across the socioeconomic spectrum in the United States. N Engl J Med 2006;355:695-703. DOI 10.1056/NEJMsa044316

45. Goldman D, Smith JP. Socioeconomic differences in the adoption of new medical technologies. Am Econ Rev 2005;95:234-7.

46. Kaul P, Armstrong PW, Chang WC, et al. Long-term mortality of patients with acute myocardial infarction in the United States and Canada: comparison of patients enrolled in Global Utilization of Streptokinase and t-PA for Occluded Coronary Arteries (GUSTO)-I. Circulation 2004;110:1754-60.

47. Alexander KP, Peterson ED, Granger CB, et al. Potential impact of evidence-based medicine in acute coronary syndromes: insights from GUSTO-IIb. Global Use of Strategies to Open Occluded Arteries in Acute Coronary Syndromes trial. J Am Coll Cardiol 1998;32:2023-30.

48. Majumdar SR, McAlister FA, Soumerai SB. Synergy between publication and promotion: comparing adoption of new evidence in Canada and the United States. Am J Med 2003;115:467-72.

Comparación del Impacto del Ensayo de Investigación del Seguimiento de la Fibrilación Auricular de las Terapias del Ritmo (AFFIRM) Sobre los Patrones de Prescripción: Un Análisis de Series de Tiempo

NK Choudhry, B Zagorski, J Avorn, R Levin, K Sykora, A Laupacis, y M Mamdani

EXTRACTO

TRASFONDO: El ensayo de investigación del seguimiento de la fibrilación auricular de las terapias del ritmo (AFFIRM) demostró que las estrategias del control de la frecuencia y del ritmo tienen como resultado una supervivencia y una calidad de vida similar en pacientes con fibrilación auricular (FA). Dada su mayor seguridad y su menor coste, las terapias para el control de la frecuencia constituyen ahora la estrategia recomendada para el tratamiento de la mayoría de los pacientes con FA de edad avanzada y de alto riesgo.

OBJETIVOS: Buscamos determinar hasta qué punto los resultados del ensayo AFFIRM han sido adoptados en la práctica real.

MÉTODOS: Se establecieron análisis de series de tiempo de 3 cohortes de población de pacientes con FA ≥66 años en Pensilvania (EE.UU.) y Ontario (Canadá). Estratificamos los pacientes en Ontario por su estatus socioeconómico (ESE) y examinamos los cambios en las tasas de prescripción trimestral para los medicamentos para el control de la frecuencia y del ritmo cardiaco, así como los procedimientos de cardioversión antes y después de la publicación del ensayo AFFIRM.

RESULTADOS: La publicación de AFFIRM resultó en una reducción estadísticamente significativa del uso de medicamentos para el control del ritmo en las 3 cohortes (p < 0.01). La magnitud de estos cambios en la cohorte canadiense de ESE no-inferior fue aproximadamente de 1% por trimestre y fue superior que los observados en las otras cohortes (p < 0.001). El uso de procedimientos de cardioversión también descendieron en todas las regiones del estudio (p < 0.01). Por contra, la publicación AFFIRM también se asoció con un pequeño descenso del uso medicamentos para el control de la frecuencia cardiaca en Canadá (p < 0.01) pero no en EE.UU. (p = 0.23).

CONCLUSIONES: La publicación del ensayo AFFIRM resultó en cambios pequeños pero estadísticamente significativos en el tratamiento de los pacientes con FA.

Traducido por Enrique Muñoz Soler

Comparaison de l'Impact d'Une Étude de Contrôle du Rythme en Fibrillation Auriculaire sur la Prescription: Analyse Sériée dans le Temps.

NK Choudhry, B Zagorski, J Avorn, R Levin, K Sykora, A Laupacis, et M Mamdani

RÉSUMÉ

INFORMATION: L'étude AFFIRM (Atrial Fibrillation Follow-up Investigation of Rhythm Management) a démontré que les stratégies de contrôle de la fréquence cardiaque et les stratégies de contrôle du rythme étaient équivalentes en terme de survie et de qualité de vie chez les patients avec fibrillation auriculaire (FA). À cause d'une innocuité supérieure et d'un coût moindre, la stratégie de contrôle de la fréquence cardiaque est maintenant recommandée lors du traitement de la majorité des personnes âgées avec la FA.

OBJECTIF: Déterminer si les résultats de l'étude AFFIRM ont été adoptés à large échelle dans la pratique actuelle.

MÉTHODOLOGIE: Une analyse sériée dans le temps composée de 3 cohortes de patients avec FA âgés de plus de 65 ans en Pennsylvanie et en Ontario a été effectuée. Les patients de l'Ontario furent stratifiés selon leur statut socioéconomique (SSE). Les changements dans la prescription de médicaments pour le contrôle de la fréquence cardiaque ou du rythme cardiaque ainsi que les procédures de cardioversion ont été évalués aux 3 mois avant et après la publication de l'étude AFFIRM.

RÉSULTATS: La publication des résultats de l'étude AFFIRM a eu comme impact de réduire l'utilisation de médicaments contrôlant le rythme cardiaque dans les 3 cohortes de patients (p < 0.01). Le degré de ces changements auprès de la cohorte canadienne à SSE élevé a atteint 1% par 3 mois et était plus élevé que celui observé auprès des autres cohortes (p < 0.001). L'utilisation de la cardioversion a été réduite dans toutes les régions à l'étude (p < 0.01). Cependant, la publication de l'étude AFFIRM fut associée à une faible augmentation de l'utilisation de médicaments contrôlant la fréquence cardiaque au Canada (p < 0.01) mais non aux États-Unis (p = 0.23).

CONCLUSIONS: La publication de l'étude AFFIRM a eu comme impact une modification faible mais statistiquement significative dans les soins offerts aux patients avec la FA.

Traduit par Marc M Perreault