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Evidence-based cardiovascular care in the community: A population-based cross-sectional study

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Abstract

Background: Ischaemic heart disease and congestive heart failure are common and important conditions in family practice. Effective treatments may be underutilized, particularly in women and the elderly. The objective of the study was to determine the rate of prescribing of evidence-based cardiovascular medications and determine if these differed by patient age or sex.

Methods: We conducted a two-year cross-sectional study involving all hospitals in the province of Nova Scotia, Canada. Subjects were all patients admitted with ischaemic heart disease with or without congestive heart failure between 15 October 1997 and 14 October 1999. The main measure was the previous outpatient use of recommended medications. Chi-square analyses followed by multivariate logistic regression analyses were used to examine age-sex differences.

Results: Usage of recommended medications varied from approximately 60% for beta-blockers and angiotensin converting enzyme (ACE) inhibitors to 90% for antihypertensive agents. Patients aged 75 and over were significantly less likely than younger patients to be taking any of the medication classes. Following adjustment for age, there were no significant differences in medication use by sex except among women aged 75 and older who were more likely to be taking beta-blockers than men in the same age group.

Conclusions: The use of evidence-based cardiovascular medications is rising and perhaps approaching reasonable levels for some drug classes. Family physicians should ensure that all eligible patients (prior myocardial infarction, congestive failure) are offered beta-blockers or ACE inhibitors.

Background

Ischaemic heart disease (IHD) and congestive heart failure (CHF) are conditions commonly encountered in primary care, and optimal management by family physicians (FPs) in concert with other health care providers should increase the chance of an optimal patient outcome. In recent years, the ability of FPs to enhance their patients' outcomes has increased markedly, with large randomized

controlled trials demonstrating the value in patients with IHD of beta blocking agents (BBs), antithrombotic agents and antilipemic agents, and angiotensin converting enzyme (ACE) inhibitors in patients who also have moderate to severe left ventricular dysfunction. This evidence was summarized, and the benefit of treating hypertension in patients with IHD to target levels was reaffirmed, in five recommendations included in a 1997 consensus statement for Canadian physicians [1].

A PubMed search for utilization of those drug groups in Canada revealed few articles about ambulatory patients. In 1993–1995, BBs were dispensed to 51.4% of patients in the year following a myocardial infarction (MI) in Ontario, and significantly fewer to women and older patients [2]. Another study in Ontario revealed that older age was associated with a greater likelihood of receiving a dose lower than evaluated in trials, although there was no difference by sex in this study [3]. Acetylsalicylic acid (ASA) was used by 55% of patients post-MI in Nova Scotia in 1995 [4]. With respect to the management of hypertension in Canada, data from the Canadian Heart Health Survey (n = 23,129) gathered from 1986 to 1992 have been used to estimate that 1,326,811 (66%) patients are treated out of 1,997,866 who are aware of their diagnosis [5].

While complete and accurate data on appropriate use of medications in ambulatory patients are not yet available in Nova Scotia, a reasonable perspective may be gained through the use of information collected from patients on admission to hospital regarding drugs being taken for pre-existing conditions. The availability of a database for a large population-based study of cardiovascular disease, Improving Cardiovascular Outcomes in Nova Scotia (ICONS) [6], gave us the opportunity to elicit this information. Our objectives were to determine the rate of prescribing of evidence-based cardiovascular therapies and determine if these differed by patient age or sex. Specifically, we investigated the proportion of patients with IHD taking an antithrombotic agent, post-MI patients taking a BB, IHD patients with hyperlipidemia taking a lipid lowering agent, IHD patients with hypertension taking a drug with antihypertensive properties, and IHD patients with CHF taking an ACE inhibitor.

Methods

All patients admitted to hospital with IHD (unstable angina or acute myocardial infarction), CHF, or atrial fibrillation in Nova Scotia in the two-year period between 15 October 1997 and 14 October 1999 were included in the ICONS database. This study has included only those patients with IHD, with or without CHF, admitted for either diagnosis. These diagnoses were not confirmed with investigative measures, such as catheterization studies or left ventricular function measures. The procedures used to ensure a high sensitivity for identifying all eligible patients, and the data quality management measures that ensured a 95% or higher data accuracy of chart abstraction, have been previously reported [6]. All pertinent inpatient charts were abstracted by trained nurses and health record professionals for specific data elements such as history of previous illnesses and drugs taken, physical examination findings, investigations, and interventions. All parts of the chart were reviewed. All data were entered directly into a computer and downloaded daily to the project registry. Our study measures were age, sex, prior patient conditions or diagnoses as recorded in the hospital chart (IHD, MI, CHF, hyperlipidemia, hypertension), and the drugs that patients were taking prior to admission, also as recorded in the hospital chart. Drugs were classified and aggregated using the World Health Organization Anatomical Therapeutic Chemical classification system [7]. Details are available on request. Angiotensin receptor blockers (ARBs) were included with ACE inhibitors because many clinicians use them in patients intolerant of ACE inhibitors and evidence is suggestive that at least valsartan conveys a similar benefit [8]. Both warfarin and antiplatelet agents reduce the risk of another MI [9] and so have been included in a group generically termed antithrombotic agents.

This study used a two-year cross-sectional design. It examined the drug use and prior diagnoses by age and sex in patients enrolled in the ongoing ICONS cohort study. For each diagnostic group (IHD, post-MI, IHD with hyperlipidemia, IHD with hypertension, and IHD with CHF), chi-square analyses followed by multivariate logistic regression analyses were used to examine the age-sex differences in the use of the recommended evidence-based medication. The main effects of age and sex were examined in addition to the interaction of both variables. All analyses were conducted using SAS software [10]. The Queen Elizabeth II Health Sciences Center Research Ethics Committee approved the ICONS study protocol.

Results

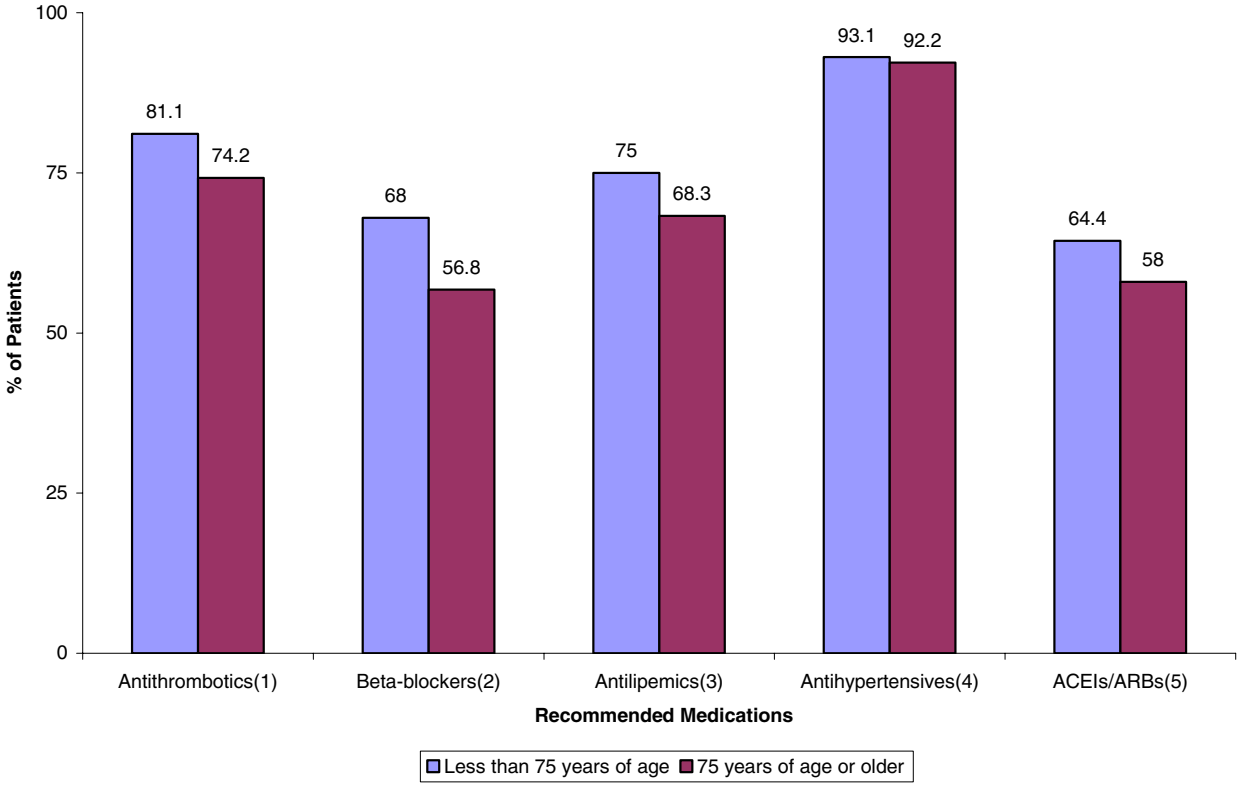
During the two-year study period, a total of 6,805 patients were admitted to hospital in Nova Scotia with IHD with or without CHF and were included in the ICONS database. The majority of patients were male (62%) and younger than 75 years of age (62.9%). Table 1 summarizes the number of patients by sex and age for each diagnostic group along with the evidence-based treatment recommendation from the 1997 consensus statement on the evaluation and management of chronic IHD [1].

Figure 1 illustrates the proportion of patients treated according to the recommendation by age group and associated significant p-values derived using chi-square analysis. Proportions varied from a low of approximately 60%

Table 1: Patient demographics by diagnostic group

Previous Diagnosis	Recommended Rx	No. of patients	Males No. (%)	Females No. (%)	Age ≤ 74 No. (%)	Age ≥ 75 No. (%)
IHD	Antithrombotic (Grade A*, Class I**)	6805	4217 (62.0)	2588 (38.0)	4281 (62.9)	2524 (37.1)
MI	Beta-blocker (Grade A, Class I)	5526	3509 (63.5)	2017 (36.5)	3398 (61.5)	2128 (38.5)
IHD + hyperlipidemia	Lipid-lowering agent (Grade A, Class II***)	3210	2071 (64.5)	1139 (35.5)	2573 (80.2)	637 (19.8)
IHD + hypertension	Antihypertensive agent (Grade A, Class I)	3594	2046 (56.9)	1548 (43.1)	2205 (61.4)	1389 (38.6)
IHD + CHF	ACEI (Grade A, Class I)	3490	1695 (48.6)	1795 (51.4)	1361 (39.0)	2129 (61.0)

* Grade A: Evidence sufficient for universal use ** Class I: Evidence based on at least one prospective randomized controlled trial *** Class II: Evidence based on at least one nonrandomized cohort comparison or multicentred case studies, chronological series or extraordinary results from nonrandomized trials.



(1) In patients with prior IHD (n=6805)
(2) In patients with prior MI (n=5526)
(3) In patients with prior IHD and hyperlipidemia (n=3210)
(4) In patients with prior IHD and hypertension (n=3594)
(5) In patients with prior IHD and CHF (n=3490)

Figure 1
Proportion of patients taking recommended medications, by age

for BBs in patients post-MI and ACE inhibitors in patients with IHD and CHF, to approximately 90% for antihypertensive agents in patients with IHD and hypertension. Within each diagnostic group, age was significantly associated with recommended treatment usage at the .05 level of significance. After accounting for sex, patients aged 75 years and over were significantly less likely than younger patients to be taking 1) any antithrombotic agent in patients with previous IHD (odds ratio [OR] 0.69; 95% confidence interval [CI] 0.61–0.78), 2) BBs post-MI (OR 0.60; 95% CI 0.54–0.68), 3) antilipemic agents among those with IHD and hyperlipidemia (OR 0.74; 95% CI 0.61 – 0.89), 4) any antihypertensive agent in patients with IHD and hypertension (OR 0.71; 95% CI 0.54–0.93) or 5) ACE inhibitors/ARBs in those with previous IHD and CHF (OR 0.77; 95% CI 0.67–0.89).

Examination of the crude proportion of males and females who received each medication does not point to major differences (Figure 2). Chi-square tests for association indicate a significant difference between males and females in medication use only among patients with previous IHD taking any antithrombotic agent ($p = 0.001$). However, following adjustments for age, this association was no longer evident. Further investigation revealed that elderly females (those aged 75 and older) with previous MI tended to have a greater likelihood of taking BBs than elderly males (OR 1.31; 95% CI 1.10–1.55). No other significant differences in recommended medication use within diagnostic groups were evident by sex.

Discussion

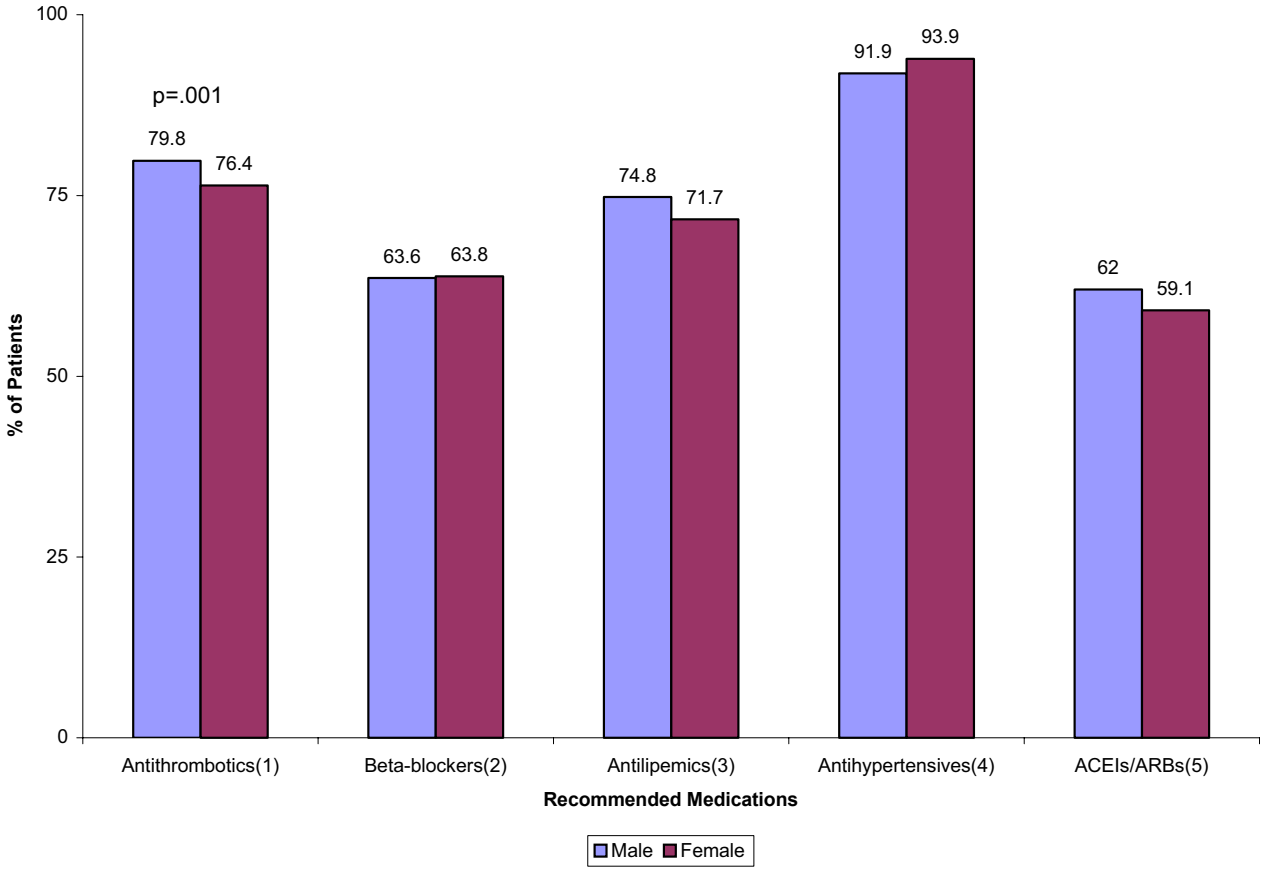
Rapid changes in cardiovascular therapies will mean that data from retrospective studies will frequently lag behind published evidence. Our results indicated a trend toward compliance with evidence-based therapies, consistent with other studies [11-13]. Use of anti-thrombotic and antilipemic medication was much higher than had been reported in previous Canadian and American data,[4,14,15] perhaps close to reasonable targets given contraindications and patient freedom to decline treatment. The higher proportion of eligible patients on antilipemic medications was consistent with the reported increase in statin use following publication of major trials [16,17].

The use of drugs with antihypertensive properties in patients with prior hypertension was very high (over 90%), despite it being an asymptomatic condition. This is similar to the 92% reported in the VALUE trial baseline data.[18] Other studies of the use of antihypertensive medications have yielded a wide variation in proportions treated: 30% of men and 43% of women in Germany [19] in pooled data from 1989/90 and 1994/95; 39% of men and 55% of women in South Africa [20] in 1998; 53% of Hispanic adults, 64% of whites, and 73% of blacks in an American study [21] of data from 1992; and 80% in Belgium [22] in 2000. Perhaps the higher proportions generally seen in more recent studies indicate that both patients and physicians were more accepting of the value of antihypertensive medications in the late 1990's than they were a decade previously.[5] Additionally, patients in our study also had IHD and might be expected to make more frequent visits to the physician and have more attention paid to their BP and any necessary treatment. However, because of an overlap in indications for many drugs (e.g., BBs, ACE inhibitors, calcium channel blockers can be used to treat IHD or hypertension), it is not possible to establish with certainty that hypertension was the primary reason for treatment with these medications or that patients received an antihypertensive regimen that adequately controlled blood pressure.

In contrast, BB use post-MI was slightly higher than previous reports,[2,23] perhaps because our data were collected approximately 5 years later. ACE inhibitor use in IHD patients with CHF was also marginally higher, at approximately 60%. It is unclear what impact comorbidities, side effects, and patient refusal may have had on compliance. Some of the barriers to use of both of these drug groups can be found in a recent report from an English study [24]. The evidence supporting the value of both classes of medications is strong and plentiful [1]; given the cumulative impact of evidence over time [25], we doubt that lack of awareness by physicians is a major issue. Further research with patients who appear eligible for BBs or ACE inhibitors but are untreated is needed to clarify the reasons for this care gap and suggest strategies to optimize management.

Lower treatment levels for patients 75 and older were consistent with patterns reported in other studies [2,26-30]. This may reflect a variety of factors, including less convincing evidence for the safety and efficacy of medications for secondary prevention in the 75 and older age group [31], comorbidities, and physician attitudes towards treating the elderly. Although our data showed that antilipemic utilization was lower for the elderly group (68.3%) than for those under 75 years of age (75%), it was still higher than the 59.4% reported for the 65–75 age group in a recent American study [32]. This may be due to the public drug insurance for most seniors in Nova Scotia (Seniors' Pharmacare) in contrast to greater out-of-pocket costs in the United States. Future research is needed to identify the factors associated with differing utilization in the elderly.

In contrast to the findings of others [2,17,19,29,30,33], after adjustment for age we did not find sex differences in drug use except for BBs. Women aged 75 and older were



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(5) In patients with prior IHD and CHF (n=3490)

Figure 2
Proportion of patients taking recommended medications, by sex

found to use BBs more than men in the same age group. However, the literature provides other examples of studies in which differences by sex were absent or minimal. A recently published study [34] of post- myocardial infarction patients reported no significant differences by sex for ACE inhibitors, BBs, ASA and anticoagulants other than ASA, but the proportion of men taking antilipemic agents remained higher after adjustment for age. Weiss reported no differences between men and women in hypertension treatment [35], and Rochon found no difference in low-dose BB therapy by sex [3]. We cannot explain these variations; perhaps physicians are increasingly recognizing the importance of cardiovascular disease in women and applying the evidence to them equitably.

Despite the advantage of drawing on population-based, detailed clinical data abstracted from the medical record, our data have several limitations. Only patients who were hospitalized for a cardiovascular (CV) diagnosis in the two-year period were included, and they were presumably sicker than the usual ambulatory patient. We had no reliable data on allergies, previous adverse drug reactions or contraindications to medications and, therefore, there may have been legitimate reasons why some patients were not receiving recommended medications. The relevance

for the ICONS study of non-documentation of important clinical information in the hospital record has been described in detail in another paper [36], and we acknowledge that inaccurate self-reporting of diagnostic and drug information by patients could have contributed to that. For our subset of patients, non-documentation was 22.9% regarding presence or absence of hypertension, and 33.7% for hyperlipidemia. We do not know how our results would have changed if the relevant information were available for all patients, but we believe that no major systematic bias resulted from excluding patients with missing information. Our data were based on information documented in the hospital chart, which itself reflects self-reported diagnosis and current medication use, and this was not validated with the prescribing physician or the pharmacist. Patients may have over-reported diagnosis, and their potential memory lapses could have caused us to underestimate drug use. Nevertheless, such limitations are not unique to our study and apply to any investigation based on a retrospective review of hospital charts, which itself remains a basic source for conducting quality of care assessments of hospitalized patients.

Note that the ICONS study did collect data on comorbidities as documented in the hospital record and, hence, a cohort of "ideal" patients could have been constructed to better reflect appropriateness of use for each drug class. We chose not to do so for several reasons. First, given generic problems with documentation in any medical record, as already alluded to, there was no assurance that construction of such "ideal" cohorts would have been either accurate or comprehensive. Second, the present report was intended to allow comparison of Nova Scotia drug utilization rates with those published elsewhere, especially from other jurisdictions in Canada, where overall or population-wide and not "ideal", rates were reported. Third, we would propose that the absolute difference between the numbers of "ideal" patients and all patients eligible for treatment is in fact small, at least from the perspective of utilization rates of the four major drug classes examined (antiplatelet agents, beta-blockers, ACE inhibitors and statins).

Further to the issue of establishing appropriateness of drug use, it is true that the elderly might have relatively more comorbid conditions that, in some circumstances, might relatively or even absolutely contraindicate the use of certain medications. But most experts would agree that elderly patients would nonetheless benefit from receiving the drugs under examination, and the vast majority of older patients should be able to tolerate them as well, although some dose adjustment might be required.

Finally, one last limitation needs to be highlighted, especially as regards the use of ACE inhibitors. Because ICONS was a population-based study of usual care, not all patients underwent an objective assessment of their systolic function. Thus, it is not possible to distinguish patients with diastolic dysfunction from those with systolic or mixed systolic and diastolic dysfunction. ACE inhibitors are known to benefit patients with systolic dysfunction, but no drug (including ACE inhibitors) has been definitively shown to improve outcome in diastolic dysfunction. Having said that, during the time period under review, there was a general consensus that patients with a history of myocardial infarction stood to benefit from treatment with an ACE inhibitor and, since the publication of the HOPE study [37], this benefit has extended to patients with known or manifest coronary artery disease of any kind. To the extent that this is the one drug class wherein there existed, at least during the time interval studied, comparatively greater discretion around use, the relatively high levels of prescribing seen among primary care physicians in Nova Scotia seems especially exemplary.

Conclusions

We conclude that progress has been made in the implementation of evidence-based recommendations in cardiovascular care in ambulatory patients. However, the absence of rigorously collected community family practice data on these issues is a glaring gap in our knowledge of the care of these chronic diseases. For now, family physicians should ensure that all eligible patients with a prior MI or a history of CHF are offered BBs or ACE inhibitors. For patients with hyperlipidemia or hypertension, meeting target levels for risk reduction should complement continued attention to treating all eligible patients.

Competing interests

None declared. The Improving Cardiovascular Outcomes in Nova Scotia study was supported through a non-directed educational grant from Merck Frosst Canada Inc., and through in-kind contribution from the Queen Elizabeth II Health Sciences Centre.

Authors' contributions

WP participated in the conceptualization and design of the project, the analysis and interpretation of the data, first-drafted the majority of the article, and incorporated co-authors' comments into the final draft. FB and BL participated in the analysis and interpretation of data, and drafting and revising of the manuscript. JC, IS, GF and DZ participated in the analysis and interpretation of data and revising each draft for critical content. All authors gave approval to the final version.

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