Enhancing the Quality of Care for Patients With Coronary Heart Disease: The Design and Baseline Results of the Hastening the Effective Application of Research Through Technology (HEART) Trial

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Background: Effective therapies exist for reducing mortality in persons with coronary heart disease (CHD), but they remain underused.

Objective: To report the design and baseline results of a quality improvement project designed to increase the use of hydroxymethyl glutaryl coenzyme A (HMG-CoA) reductase inhibitors, β-adrenergic blocking agents, and angiotensin-converting enzyme (ACE) inhibitors in patients with CHD in a network-model managed care setting.

Methods: Patients with CHD were identified by searching a claims database. Use of therapies was assessed by linkage with a pharmacy benefits database. A survey was mailed to primary care physicians to collect information related to attitudes and behavioral intentions regarding aggressive management of CHD. An intervention, consisting of a guideline summary, performance feedback, and medical chart reminders, was evaluated in a randomized, practice-based trial.

Results: Among 1189 patients with CHD, the median prevalence of receipt of HMG-CoA reductase inhibitors, β-adrenergic blocking agents, and ACE inhibitors across practices at baseline (the first 3 months of 1999) was 50.0%, 35.0%, and 18.8%, respectively. Reported barriers included a perception that aggressive management of CHD is thought to be unimportant by support staff yet to require significant staff time. Aggressive management of CHD was perceived to incur nonreimbursable costs, to be unimportant in their patient population, to require a great deal of patient education and self-management, and to be limited because many patients do not adhere to therapy.

Conclusions: Opportunities exist for enhancing the quality of care provided to patients with CHD. Our experience to date supports the logistical feasibility of implementing network-level quality enhancement efforts in managed care networks.

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Despite declines in coronary heart disease (CHD) mortality and advances in care for patients with CHD, this disease remains the leading cause of death, a major cause of disability, and a substantial economic burden in the United States[1]; thus, continued emphasis on the development of effective prevention programs is needed. The efficacies of several interventions for patients with CHD have been demonstrated conclusively. This evidence was the subject of 2 comprehensive reviews[2,3] and a consensus panel statement jointly endorsed by the American Heart Association (AHA) and the American College of Cardiology.[4] In brief, smoking cessation counseling, lipoprotein management, physical activity counseling, weight management, antiplatelet or anticoagulant therapy, angiotensin-converting enzyme (ACE) inhibition (in patients with impaired left ventricular systolic function), β-adrenergic receptor blockade, postmenopausal estrogen therapy, and blood pressure management have been endorsed.[2-4]

Estimates of the use of these treatment regimens are disappointingly low. Referral to a rehabilitation program occurs in 10% of patients surviving a myocardial infarction (MI), 10% of those who undergo angioplasty, and 25% of those who undergo bypass surgery.[5] Smoking cessation counseling is provided to 20% of patients with MI, lipid-lowering therapy to 25% to 37%,[6-8] β-adrenergic blocking agent therapy to 40% to 68%,[6,9-11]

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ACE inhibitor therapy to 40% to 60% of patients with reduced left ventricular ejection fraction,[6,12] and aspirin therapy to 70%.[6] On the other hand, use of calcium channel blockers is more frequent than can be justified by evidence of clinical benefits attributed to this class of drugs.[13] Thus, one can conclude that there is substantial room for improvement in the quality of care provided to patients with CHD. In this article, we describe the design and baseline results of a randomized, practice-based trial designed to test a quality improvement project intended to increase use of lipid-lowering therapy, β-adrenergic blocking agent therapy, and ACE inhibitor therapy in a network-model managed care setting. We describe the overall use of these medications and the association of medication use with demographic attributes and comorbid conditions. In addition, we report the results of a baseline physician survey of attitudes, beliefs, and behavioral intentions regarding management of patients with CHD.

PARTICIPANTS, MATERIALS, AND METHODS

Design Overview

The Hastening Effective Application of Research Through Technology (HEART) trial is a randomized, controlled, practice-based trial designed to evaluate an intervention to improve the quality of care provided to patients with clinically diagnosed CHD in a managed care setting. Practices were selected for recruitment from those that participated in the primary service area of a network-model managed care organization (MCO) in northwestern North Carolina (PARTNERS National Health Plans of North Carolina Inc). Patients with CHD were identified on the basis of CHD-related *International Classification of Diseases, 9th Revision, Clinical Modification,* diagnosis codes[14] and Current Procedural Terminology procedure codes[15] (**Table 1**) in the claims database during the 3-year period from 1996 through 1998. Persons were required to have at least 1 inpatient encounter for CHD, at least 2 outpatient encounters for CHD, or at least 1 procedure related to the treatment of CHD to meet the criteria for this program. Data that related to prescriptions for hydroxymethyl glutaryl coenzyme A (HMG-CoA) reductase inhibitors (lipid-lowering drugs), β-adrenergic blocking agents, and ACE inhibitors were collected from the pharmacy benefits database. The baseline period for determining patterns of medication use was from January 1 through March 31, 1999. Patients who terminated enrollment before March 31, 1999, were excluded from analysis. Filling of a single prescription for a medication in the appropriate class during the 3-month period was considered sufficient to qualify as evidence of physician prescribing behavior. Physician surveys were conducted during the baseline period

Table 1. *International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM),* Codes and *Current Procedural Terminology (CPT)* Codes Used to Identify Participants With Coronary Heart Disease

Diagnosis or Procedure	Codes
Diagnosis* and *ICD-9-CM* Codes	
Acute myocardial infarction	410.00-410.92
Other acute and subacute forms of ischemic heart disease	411.0-411.89
Old myocardial infarction	412
Angina pectoris	413.0-413.9
Other forms of chronic ischemic heart disease	414.0-414.5, 414.8-414.9
Cardiovascular disease, unspecified	429.2
Procedure† and CPT Codes	
Percutaneous transluminal coronary balloon angioplasty	92982, 92984
Percutaneous transluminal coronary atherectomy	92995, 92996
Transcatheter placement of intracoronary stent	92980, 92981
Venous grafting for coronary artery bypass	33510-33516
Combined arterial venous grafting for coronary artery bypass	33517-33530
Arterial grafting for coronary artery bypass	33533-33536
Coronary endarterectomy	33572

*Participants were required to have ≥1 inpatient encounters or ≥2 outpatient encounters with ≥1 of these codes to meet the criteria for coronary heart disease on the basis of *ICD-9-CM* coding.
†Participants were required to have ≥1 of these procedures to meet the criteria for coronary heart disease on the basis of *CPT* coding.

to assess beliefs, attitudes, and behavioral intentions regarding the treatment of patients with CHD. The intervention (described in detail in the "Intervention Methods" section) consisted of guideline dissemination, performance audit with peer comparison performance feedback reports, and patient-specific medical chart reminders. The anticipated outcomes included an increase in the proportion of patients with CHD receiving each of the following therapies: HMG-CoA reductase inhibitors, β-adrenergic blocking agents, and ACE inhibitors.

Study Population

PARTNERS National Health Plans of North Carolina Inc, a network-model MCO based primarily in the northwest region of North Carolina, included more than 800 primary care practices, 2100 primary care physicians, and 179 000 enrollees in 1998. Approximately 85% of enrolled patients lived in the 8-county region referred to as the northwest Piedmont (Davidson, Davie, Forsyth, Guilford, Iredell, Stokes, Surrey, and Yadkin). Approximately 75% of practices participating in the network were located in this region. These practices and enrollees (in the northwest Piedmont) constituted the target population for this study. Practices in the PARTNERS network were selected for recruitment based on (1) being located within the 8-county area referred to as the northwest Piedmont and (2) having a relatively large number of PARTNERS enrollees. Both criteria were chosen for logistical purposes, the former to reduce logistical demands and the latter to maximize power and increase the salience of the project for the practices.

Quality of Care Monitoring System

Two administrative databases were linked through the use of programs designed to query and match across these databases. The physician encounter claims database served as the source for identifying patients with clinically diagnosed CHD based on the diagnosis and procedure codes shown in Table 1. The pharmacy benefits management claims database served as the source of data regarding treatment practices, that is, use of HMG-CoA reductase inhibitors, β-adrenergic blocking agents, and ACE inhibitors. This database included information regarding prescriptions filled by patients at pharmacies; thus, medications that were prescribed but not purchased were not included. Although this feature limited the usefulness of this database for accurately monitoring physician prescribing practices, it enhanced the utility of this database (compared with medical chart audits, which were not done in this project) to examine actual prescription medication use. In contrast to the approach used in this project, medical chart audits might have represented physician prescribing practices more accurately and patient medication use less accurately.

The database created by linking the administrative databases was used to provide these baseline results regarding the quality of care provided to patients with clinically diagnosed CHD. The demographic characteristics of the study population used in this study were age and sex. Information on race and ethnicity was not collected by this MCO. The population of North Carolina is approximately 70% white, 21% black, 5% Hispanic, and 4% other. Although these proportions may be reasonably good approximations for the population that resides in the region served by this MCO, we do not know the racial and ethnic composition of the enrolled population. Quality measures included the proportion of patients who received HMG-CoA reductase inhibitors, β-adrenergic blocking agents, and ACE inhibitors. These measures were monitored for the overall population and for subgroups defined by demographic characteristics, that is, age (<65 years vs ≥65 years) and sex. In addition, information on comorbid conditions was examined based on diagnosis codes.

Physician Survey

A mailed survey was conducted at baseline to assess physician beliefs, attitudes, and behavioral intentions regarding the treatment of patients with CHD. The study survey instrument was developed by one of us (SJC) based on the theory of reasoned action, which states that behavioral intentions are the most proximal predictors of behavior and that perceived norms and beliefs are important predictors of behavioral intentions.[16] Hence, the survey focused on assessing behavioral intentions and perceived norms and beliefs regarding management of CHD. The original study plan included repeating the survey after implementation of the intervention to enable determination of whether physician beliefs, attitudes, and behavioral intentions influenced the response to the intervention and to assess the impact of the intervention on these variables. However, the low baseline response rate reduced the utility of this design feature, so this survey was not repeated.

Intervention Methods

The intervention included dissemination of the AHA recommendations for the secondary preven-

tion of CHD, performance audit with peer comparison performance feedback, and patient-specific medical chart reminders. Key aspects of the AHA guidelines, including recommendations regarding smoking cessation counseling and the use of aspirin, HMG-CoA reductase inhibitors, β-adrenergic blocking agents, and ACE-inhibitors, were disseminated in summary form by mail and were incorporated into the medical chart reminder cards, which were also mailed. As a measure of process evaluation, practices were telephoned during the week after the mailing to inquire whether the cards were received. In addition, the reminder cards were developed to facilitate an optional reply regarding reasons for not treating patients with specific drugs. The proportion of practices returning at least 1 card and the proportion of cards returned served as other process evaluation measures. The peer comparison performance feedback reports were generated by staff of the MCO using the quality of care monitoring system described in a previous section in this article. The reliance on administrative databases reduced the ability to identify a group of patients free from all contraindications to each medication; hence, we did not propose a goal of 100% use. Instead, we presented the level of use observed in the 80th percentile practice at baseline as a level that should be attainable, with effort, by most practices. Hence, the performance report included the practice's current performance for 3 performance indicators (the proportion of patients with CHD using HMG-CoA reductase inhibitors, β-adrenergic blocking agents, and ACE inhibitors) and the 50th and 80th percentiles for each of these performance indicators across the network at baseline. The intervention was delivered annually in the summers of 1999, 2000, and 2001. This intervention was designed based on a systems change approach in the office setting. The intervention development was guided by behavior change theory and implementation theory. The primary guiding behavior change theories were the theory of reasoned action[16] and social-cognitive theory[17]; the guiding implementation theory was diffusion theory.[18]

Systems changes were targeted at 2 levels: the entire MCO and the practice. At the MCO level, the implementation of the ongoing quality of care monitoring system, the generation of peer comparison feedback reports, and the generation of patient-specific medical chart reminders represented major changes in operations. Systems changes were also required at the practice level. Practice staff had to agree to incorporate the patient-specific medical chart reminders at a highly visible location in the clinic medical chart, and physicians had to agree to refer to the reminder when the patient was seen. Practice staff and physicians were also requested to review the peer comparison performance feedback reports disseminated by the MCO.

Effectiveness Trial

The intervention was tested in a randomized, controlled, practice-based trial. The anticipated outcomes included an increase in the proportion of patients with CHD receiving each of the recommended therapies (HMG-CoA reductase inhibitors, β-adrenergic blocking agents, and ACE inhibitors). Impact measures and potential mediating influences were assessed from the physician surveys. Process data were collected, as described in a previous section, annually after each intervention cycle during the intervention period. Data regarding the care provided during the first quarter of calendar year 1999 served as the baseline. Data regarding the care provided during the first quarter of calendar year 2002 served as the outcome data. This project was approved by the institutional review board at Wake Forest University School of Medicine, Winston-Salem, NC, and by the Utilization Review/Quality Improvement Committee of PARTNERS.

Analytic Plan

The study design included random assignment of clinic practices to intervention or control conditions and patient-level measurement of outcomes. Thus, the outcome data came from clusters of patients within physicians within practices. The analytic plan assumed that physicians within a practice and patients within a physician were more similar than patients or physicians in different clinic practices. Because of the clustered nature of the design, the analytic technique must take into account the intraclass correlation coefficient (ρ). The generalized estimating equations approach allows modeling of binary end points with a clustered data design.[19] Because the effect of the intervention on binary end points was of primary interest, we adopted a "population-averaged" approach to these analyses, that is, we asked, "What was the average population response to the intervention compared with the control?" This approach is in contrast to examination of a cluster (physician or clinic practice)-specific effect that examines what happened within a patient or within a physician. The interaction between time and treatment group on binary outcomes was the effect of primary interest. The out-

comes of interest included use of HMG-CoA reductase inhibitors, β-adrenergic blocking agents, and ACE inhibitors.

Sample size estimates were determined assuming use of a 2-sample *t* test approach for estimating the net intervention effect on the proportion of patients receiving treatments. First, we calculated the sample size obtained by assuming that all patients were statistically independent and then multiplying the result by a design effect equal to $1 + (m - 1)\rho$, where m represents the size of each cluster (ie, the number of patients with CHD within each practice) and ρ represents the intraclass correlation coefficient. This approach inflated the sample size required to account for the intraclass correlation.[20] The power to detect selected differences for any of the various outcomes is shown in **Table 2** for a moderate control group prevalence (45%) given an overall 2-sided α of .05 and intraclass correlation coefficients of 0.05 and 0.10. (Given the number of outcomes of interest, we guarded against a type 1 error by using a Bonferroni adjustment; thus, the level of significance for each outcome was set at 0.01.) We expected (conservatively) to have more than 600 patients with CHD available across approximately 60 practices, for an average of at least 10 patients with CHD per practice. Inclusion of 60 practices, 30 randomized to each arm, would have provided sufficient power to detect meaningful intervention effects (eg, an approximately 20% or greater increase in prevalence of desirable outcomes). Given the expected prevalence of use of the targeted interventions and their efficacies, a 20% improvement in use was judged to be worth the effort required to implement this intervention. If the effect of this intervention was truly smaller than a 20% increase, one might question the utility of the intervention.

Table 2. Power to Detect Differences in Treatment Use Associated With Intervention at 2 Levels of Intraclass Correlation Coefficient (ρ)

Intervention Effect (%)	Power (ρ = 5%)	Power (ρ = 10%)
18	0.84	0.70
19	0.89	0.76
20	0.92	0.81

The baseline data were analyzed using generalized estimating equation methods with a compound symmetry correlation matrix, which assumed equal correlation of each patient with each other patient within practices.[19] Covariates considered for inclusion in the models were age, sex, presence of selected comorbid conditions (chronic obstructive pulmonary disease, diabetes mellitus, and hypertension), and cardiovascular disease-related diagnoses or procedures (MI, cerebrovascular disease, peripheral arterial disease, aortocoronary bypass surgery, and percutaneous transluminal coronary interventions). Covariates were included in the models when the *P* value associated with the regression coefficient was <.05, with the exception that age and sex were included in all models. All analyses were conducted using statistical software (SAS version 8.1; SAS Institute Inc, Cary, NC).

Table 3. Prevalence of Use of ACE Inhibitors, β-Adrenergic Blocking Agents, and HMG-CoA Reductase Inhibitors Among Participants With CHD During the First Quarter of 1999*

	Patient-Level Prevalence, %†		Practice-Level Prevalence, %‡	
Medication	Intervention Group	Comparison Group	50th Percentile	80th Percentile
HMG-CoA reductase inhibitors	50.1	48.7	50.0	69.2
β-adrenergic blocking agents	37.9	39.5	35.0	55.6
ACE inhibitors	21.5	22.9	18.8	40.0

ACE indicates angiotensin-converting enzyme; HMG-CoA,hydroxymethyl glutaryl coenzyme A; CHD, coronary heart disease.
*Filling a single prescription for a medication in the specified class during the 3-month period was sufficient to meet the criteria for use.
†Patient-level prevalence refers to the prevalence of use across all patients without aggregating to the practice level.
‡Practice-level prevalence refers to prevalence of use after aggregating patient-level data regarding use at the practice level.

Table 4. Multivariable-Adjusted* Odds Ratios for Receipt of Medications by Patient Characteristics

	Odds Ratio	(95% CI)	*P*
HMG-CoA reductase inhibitors			
Age (/10 y)	1.19	(1.02-1.38)	.03
Sex (women/men)	0.71	(0.55-0.92)	.009
PTCI (yes/no)	1.96	(1.40-2.74)	<.001
β-adrenergic blocking agents			
Age (/10 y)	0.98	(0.85-1.23)	.73
Sex (women/men)	1.09	(0.86-1.37)	.49
COPD (yes/no)	0.60	(0.43-0.84)	.003
Hypertension (yes/no)	1.69	(1.36-2.10)	<.001
History of myocardial infarction	1.50	(1.13-2.00)	.005
PTCI (yes/no)	1.42	(1.01-2.01)	<.05
ACE inhibitors			
Age (/10 y)	1.25	(1.03-1.52)	.02
Sex (women/men)	0.82	(0.62-1.10)	.18
Diabetes mellitus (yes/no)	2.57	(1.90-3.49)	<.001
Hypertension (yes/no)	3.08	(2.15-4.40)	<.001
PTCI (yes/no)	1.49	(1.08-2.05)	.01

CI indicates confidence interval; HMG-CoA, hydroxymethyl glutaryl coenzyme A; PTCI, percutaneous transluminal coronary intervention; COPD, chronic obstructive pulmonary disease; ACE, angiotensin-converting enzyme.
*For each medication, the model included the terms shown and a random effect to account for practice-level variation.

RESULTS

A total of 184 practices were randomized to intervention (n = 97) or comparison (n = 87) conditions. The greater number of practices randomized (n = 184) than expected (n = 60) was possible owing to the greater-than-expected availability of practices within the network. The imbalance in assignment may be attributable to our decision not to block the randomization process. At baseline, 1189 patients met study criteria for CHD, including 670 from 81 of the intervention practices and 519 from 73 of the comparison practices. The remaining 18 intervention practices and 14 comparison practices had no qualifying patients at baseline. The number of patients per practice ranged from 1 to 62 and from 1 to 69 in the intervention and comparison practices, respectively. The intervention and comparison practice patient groups were similar with respect to age (mean [SD], 55.4 [7.6] and 54.4 [7.9] years, respectively) and sex (23.1% and 29.9% female, respectively).

The use of HMG-CoA reductase inhibitors, β-adrenergic blocking agents, and ACE inhibitors was similar between groups randomized to receive or not receive the intervention (**Table 3**). Across all patients, approximately half filled at least 1 prescription for an HMG-CoA reductase inhibitor, two fifths filled at least 1 prescription for a β-adrenergic blocking agent, and one fifth filled at least 1 prescription for an ACE inhibitor. When the data were analyzed at the practice level to generate performance feedback reports, the 50th (median) and 80th percentiles of use were 50.0% and 69.2% for HMG-CoA reductase inhibitors, 35.0% and 55.6% for β-adrenergic blocking agents, and 18.8% and 40.0% for ACE inhibitors.

The results of analyses exploring the associations of medication use with demographic attributes and comorbid conditions are shown in **Table 4**. Use of HMG-CoA reductase inhibitors was more frequent in older individuals, men, and persons who had undergone a percutaneous transluminal coronary intervention. Use of β-adrenergic blocking agents was less frequent in persons with chronic obstructive pulmonary disease and more frequent in those with hypertension or a previous diagnosis of acute MI and those who had undergone a percutaneous transluminal coronary intervention. Use of ACE inhibitors was more frequent in the older population, persons with coexisting diabetes mellitus or hypertension, and those who had undergone a percutaneous transluminal coronary intervention.

Ninety (14.9%) of the 605 surveys mailed to physicians were returned. Physician beliefs and behavioral intentions about the management of patients with CHD are shown in **Tables 5** and **6**. Most responding physicians reported that patients with CHD should be seen 3 or 4 times per year. Most respondents reported spending 5 to 10 minutes discussing CHD and counseling smokers to quit at

Table 5. Primary Care Physicians' Beliefs About Treatment of Coronary Heart Disease (CHD)

Survey Question	Response Percentile				
	Minimum	25th	50th	75th	Maximum
How many visits per year should a typical patient with CHD have with their primary care physician?	2	3	4	4	10
On average, how many minutes do you spend discussing CHD with a CHD patient during a routine follow-up visit?	1	5	8	10	30
On average, at how many visits per year do you counsel CHD patients who smoke to quit?	1	3	4	4	8
What percentage of your patients with CHD are candidates for					
aspirin therapy?	50	90	95	100	100
Lipid-lowering therapy?	50	75	80	91	100
β-adrenergic blocking agent therapy?	20	50	75	90	100
ACE inhibitor therapy?	25	50	75	90	100
Cardiac rehabilitation?	0	20	50	75	100

every visit. There was substantial consensus that aspirin therapy was indicated for almost all patients with CHD and that lipid-lowering therapy was indicated for more than 75% of patients. There was substantial variability regarding the use of β-adrenergic blocking agents and ACE inhibitors and no consensus regarding the utility of cardiac rehabilitation.

Several barriers to the aggressive management of CHD were noted by physician respondents (Table 6), including a perception that the aggressive management of CHD is thought to be unimportant by support staff yet to require significant support staff time. In addition, aggressive management of CHD was perceived to incur nonreimbursable costs, to be unimportant in their patient population, to require a great deal of patient education and self-management, and to be limited because many patients do not adhere to therapy. The other issues addressed were not viewed as important potential barriers by these respondents. These physicians agreed that primary care physicians, not specialists, should take the primary responsibility for management of CHD. Physicians reported that their time, resources, and level of training were not barriers; that their efforts were aided by the use of clinical practice guidelines; and that the aggressive management of CHD gave them satisfaction and improved their patients' general health and satisfaction with care. There was consensus regarding the effectiveness of therapy with lipid-lowering drugs, β-adrenergic blocking agents, and ACE inhibitors.

DISCUSSION

These results confirm the existence of opportunities to enhance the quality of care provided to patients with CHD enrolled in this MCO. Approximately half of these patients were treated with HMG-CoA reductase inhibitors, two fifths with β-adrenergic blocking agents, and one fifth with ACE inhibitors. It was the goal of the HEART trial to test an approach designed to enhance the appropriate use of these medications.

These practice patterns should be interpreted with caution compared with other published studies. The evidence cited previously indicated that 40% to 60% of heart attack patients with a low left ventricular ejection fraction were treated with an ACE inhibitor.[6,12] In contrast, our population was much more broadly inclusive, consisting of all patients with CHD regardless of ejection fraction. Hence, the published estimates of use are not comparable with our estimate of 20% use in a much broader group of patients with CHD. No comparable results have been published, to our knowledge, and we have no data regarding ejection fraction. Likewise, in published studies,[6,9-11] 40% to 68% of

Table 6. Primary Care Physicians' Beliefs About Aggressive Management of Coronary Heart Disease (CHD)

I Feel That the Aggressive Management of CHD. . .	Response, %				
	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
Takes too much of my time	34	51	4	9	1
Would require additional training on my part	12	45	21	19	3
Would require additional training for my staff	18	58	9	11	4
Would require hiring specially trained staff	19	55	19	5	3
Is aided by the use of clinical practice guidelines	1	7	21	64	7
Gives me satisfaction	1	3	8	70	18
Is thought to be important by support staff	46	50	3	1	0
Requires significant support staff time	3	26	29	39	3
Incurs nonreimbursable costs	4	11	26	42	18
Leads to better patient quality of life	3	3	1	71	22
Is not important in my patient population	1	5	32	52	9
Does not significantly improve general health	36	59	1	1	3
Should be done primarily by specialists	42	47	8	3	0
Is frustrating because I cannot do what I want to	15	55	16	15	0
Will increase patient satisfaction with care	3	4	16	66	12
Is not important because it is not a significant medical problem for my patients	41	58	0	1	0
Requires resources that I usually do not have available	8	62	21	9	0
Should be done by primary care physicians	4	3	9	49	35
Requires a great deal of patient education	0	12	8	64	16
Requires a great deal of patient self-management	0	8	8	67	17
Is aided by participation in cardiac rehabilitation programs	0	1	20	71	8
Is limited because					
Many patients do not adhere to therapy	3	24	20	49	5
Lipid-lowering drugs are ineffective	37	59	1	0	3
β-adrenergic blocking agents are ineffective	33	62	4	0	1
ACE inhibitors are ineffective	34	59	5	0	1
Is limited by poor access to cardiac rehabilitation programs	9	47	24	16	4

heart attack patients were treated with β-adrenergic blocking agents. We observed that approximately 40% of a broader group of patients with CHD were treated with β-adrenergic blocking agents. The multivariable analysis indicated that the odds of β-adrenergic blocking agent use was 50% greater, translating into an estimated 50% prevalence of use among patients with a history of MI, a value that is well within the published range. With respect to HMG-CoA reductase inhibitors, the observed prevalence of use, approximately 50%, far exceeds the reported prevalence of 25% to 37%.[6-8] This difference is likely attributable to the effects of the dissemination of results of key clinical trials[21-23] and a previous quality enhancement initiative focused on the use of HMG-CoA reductase inhibitors in this network.[24]

We relied on the use of administrative databases and practice surveys rather than on medical chart audits; hence, the data collection aspects of this project were relatively easy and inexpensive to implement. Completeness of the administrative databases is a potential limitation. Given the serious nature of CHD and the current financial incentives to record diagnoses on encounter forms, we believe that the use of CHD-related diagnosis codes is a highly sensitive screening procedure for patients with CHD; however, the specificity may be lower than desired. That is, very few patients with significant CHD

would be missed; however, some of the patients identified through this process, especially those identified on the basis of diagnoses rather than procedures, might not have had clinically significant CHD. Because these "false" CHD cases might be treated less aggressively than those with significant CHD, the inclusion of these false cases might be expected to result in an underestimate of the compliance with treatment recommendations. In this regard, it might be interesting to note that patients who had undergone a percutaneous transluminal coronary intervention were more likely to receive each of the 3 medications examined herein. For diagnoses associated with hospitalizations, the specificity of the 410 (acute MI) and 411 (other acute ischemic heart disease) diagnosis codes and the procedure codes are clearly acceptable.[25] Little is known regarding the validity of the less-specific codes (412-414, chronic ischemic heart disease codes), especially in the ambulatory setting. The pharmacy benefits database is thought to be nearly complete for these cardiovascular medications because these medications are taken chronically and are expensive. Thus, the likelihood that an enrollee would elect not to take advantage of the pharmacy benefit is believed to be low. Reliance on administrative data precluded assessment of other potentially important variables, such as cigarette smoking, family history of coronary artery disease, obesity, history of muscular problems, dizziness, etc.

Despite these limitations, the results of the multivariable analysis reported herein were as expected for the most part. The sex disparity in the use of HMG-CoA reductase inhibitors had been observed previously in this setting.[24] The use of β-adrenergic blocking agents was more common in persons with hypertension or a history of MI and less common in persons with chronic obstructive pulmonary disease. The use of ACE inhibitors was more common in persons with diabetes mellitus or hypertension. The observation of these expected patterns of use might provide reassurance regarding the quality of these data sources. The absence of an association between history of MI and use of HMG-CoA reductase inhibitors was not expected. It seems that the subgroup of patients that received a percutaneous intervention was the CHD subgroup that these physicians treated most aggressively. Perhaps the active involvement of a cardiologist was a key force influencing the intensity of treatment in these patients.

The insights that can be gained from the physician survey are limited by the poor survey response rate. We were somewhat constrained in our ability to encourage a greater response rate by our agreement with leadership of the MCO that we would not contact the physicians participating in the managed care network more than once. As per this agreement, a single mailing of the survey was approved, and no follow-up telephone calls were conducted to encourage survey completion. Better response rates might have been obtained with repeated mailings and follow-up calls.

The intervention component of the HEART trial consisted of a summary of practice guidelines related to the treatment of patients with CHD, practice-specific performance feedback with peer comparison benchmarks, and patient-specific medical chart reminders. Hence, the intervention was feasible to implement in a network-model MCO. Furthermore, this intervention addressed several of the barriers cited by the physicians.

The baseline results of the HEART trial support the contention that opportunities exist for enhancing the quality of care provided to patients with CHD. Our experience to date supports the logistical feasibility of network-level quality enhancement efforts implemented by MCOs. Finally, our experience supports the value of collaboration between MCOs and academic health centers in efforts to enhance patient care and outcomes. Pending the final results of the HEART trial, we recommend implementation of network-level quality enhancement programs by MCOs.

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