

# Comanagement of Patients with Congestive Heart Failure by Family Physicians and Cardiologists: Frequency, Timing, and Patient Characteristics

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**BACKGROUND.** Many patients with congestive heart failure (CHF) receive care solely from a primary care physician, while some receive care from both a primary care physician and a cardiologist. Patients in the latter type of care relationships have not been described. The principal objectives of our study were to determine what percentage of patients with CHF are comanaged, the characteristics of comanaged CHF patients, and when in the natural history of CHF this relationship is initiated.

**METHODS.** A retrospective record review was conducted of all patients who met the modified Framingham criteria for the diagnosis of CHF in a large community-based family practice office. Comanagement was defined as an ongoing relationship with a cardiologist characterized by a minimum of one visit to the cardiologist's office in the year of evaluation. We divided the natural history of CHF into 4 stages to describe the timing of the initial referral to the cardiologist: I Prediagnosis; II Diagnosis; III Progression; and IV Terminal.

**RESULTS.** Of 151 patients identified with CHF, 36% of the patients were comanaged by a primary care physician and a cardiologist. The comanagement relationship often began early in the development of CHF, 20% at stage I and 54% at stage II. The patients who were comanaged were younger, predominately men, had a greater frequency of myocardial infarction, were more likely to have decreased systolic function, were on more cardiac medications, and had fewer hospitalizations for CHF exacerbations compared with CHF patients managed solely by family physicians.

**CONCLUSIONS.** Comanagement of patients with CHF is a common occurrence, and comanaged CHF patients have distinct characteristics from those managed solely by family physicians. These results have implications for the quality and cost of caring for patients with CHF and suggest that more detailed study is required.

**KEY WORDS.** Heart failure, congestive; referral and consultation; history; family practice. (*J Fam Pract* 1999; 48:188-195)

The process of consultation and patient referral between primary care physicians and their subspecialty colleagues is an important aspect of medical practice. Observational studies have examined primary care physicians' decisions to initiate patient referrals,<sup>1,2</sup> and researchers have suggested guidelines for interspecialty communication for effective consultative relationships.<sup>3,4</sup> Fewer studies have described the effect of consultation and referral on the clinical outcomes of patients with chronic illness.<sup>5</sup>

Congestive heart failure (CHF) is a chronic condition commonly encountered by family physicians, general internists, and cardiologists. CHF affects nearly 2 million people in the United States, resulting in more than 600,000 hospitalizations, frequent readmission to the hospital within 90 days, high 5-year mortality rates, and economic costs of more than \$10 billion each year.<sup>6,8</sup> Because CHF is the eventual outcome of most forms of cardiovascular

disease, there are many reasons a patient may be referred to a cardiologist before, after, or at the time of CHF diagnosis. The level of involvement by a cardiologist can vary widely, ranging from a single hospital consultation to a referral with frequent follow-up in the outpatient setting.

A consultation involves another physician performing a specific diagnostic or therapeutic task, without transfer of responsibility for the patient's care or even ongoing management of a problem.<sup>5</sup> A referral involves sending a patient to another physician for ongoing management of a specific problem with the expectation that the patient will continue to see the original physician for coordination of total care.<sup>5</sup> A patient's ongoing relationships with both a cardiologist and a primary care physician who coordinate treatment for the same condition might better be termed comanagement.

The cardiologist's level of involvement in the care of a patient with CHF may affect that patient's outcomes, but the reported findings are inconsistent. Data from the Medical Outcomes Study revealed that cardiologists order more tests, have higher prescription rates, and hospitalize more patients for the same cardiovascular disorders than family physicians.<sup>9</sup> In a study of Veterans Administration patients with CHF who were managed by

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a cardiologist with no involvement from a primary care physician, an intervention was introduced to improve access to general internists and geriatricians, with the intention of reducing hospitalizations.<sup>10</sup> The primary care intervention increased rather than decreased the rate of hospitalization. In contrast to these findings, a multidisciplinary intervention that included intensive patient education, case management by a cardiovascular research nurse, and oversight by a geriatric cardiologist reduced hospital admissions by 56%.<sup>11</sup>

The process of physician comanagement of patients with CHF has received minimal attention. A wide variety of circumstances may prompt family physicians to seek input and advice from a cardiologist. Consultation or referral may occur before diagnosis of CHF for management of cardiovascular disease, for early monitoring or diagnosis of CHF, for assisting with therapeutic decisions, or to evaluate other cardiovascular disease that will affect the clinical course. As a consequence, the roles and responsibilities of the family physician and the cardiologist in comanaging these patients may be ambiguous. In 4 studies of nonurgent referrals in family practice offices, family physicians could not agree on the necessity of more than 40% of requested referrals for cardiovascular problems.<sup>1,3,12,13</sup> This indicates that considerable discretion exists in the appropriateness of cardiovascular referrals by family physicians.

The purpose of this study was to explore the characteristics and patterns of comanagement among patients with CHF in a large family practice office setting. More specifically, the primary objectives of the study were to determine (1) the proportion of CHF patients who were comanaged with a cardiologist during the year of evaluation; (2) when in the natural history of CHF the comanagement relationship had begun; (3) why comanagement was initiated, and (4) the characteristics of patients who were comanaged in terms of functional status, left ventricular ejection fraction, comorbid conditions, medications prescribed, and emergency department visits and hospitalizations.

## METHODS

A retrospective chart review was completed for all patients with CHF who received care in our ambulatory practice from July 1, 1994, to June 30, 1995. This study was conducted in the Family Practice Center and the inpatient service of the University of Cincinnati Department of Family Medicine Residency program, located in the Franciscan Hospital—Mt. Airy Campus, a 150-bed community hospital located in a middle-class, suburban neighborhood in Cincinnati, Ohio. The Family Practice Center functions as a large group practice with faculty and resident physicians practicing together in 4 patient care teams. The residency program had 8 faculty family physicians and 24 resident physicians during the study period. Any referrals initiated by residents had faculty input at the time of the

decision to refer. Comanagement occurred primarily with private practice cardiologists who had admitting privileges at the Franciscan Hospital.

The practice provided care for a total of 7846 patients drawn from western Hamilton County during the study period; 56% were older than 35 years. The ethnic composition of the patient population during the year of study was 85% white, 15% African American, and 1% other groups, including Asian, Native American, and Hispanic.

## PATIENT IDENTIFICATION AND RETROSPECTIVE CHART AUDITS

Both prospective and retrospective methods were used to ensure identification of all patients with CHF who received care in the Family Practice Center during the year of study. Patients were identified through computerized billing data from inpatient and outpatient visits between July 1, 1994, and December 31, 1995. Patients were also identified by their physicians, between October 1994 and June 1995 at the point of service, using a template office note for patients with CHF. The template office notes were duplicate forms that included check-off boxes for diagnostic criteria, heart failure etiology, comorbid conditions, New York Heart Association (NYHA) classification, and medications. These forms were filled out by the physicians at the time of the visit. The template notes prompted physicians to include information that may not have been recorded in a standard office note. This contributed to a low rate of missing data when charts were reviewed, with no more than 10% of data missing for any of the patient variables listed.

We identified a total of 151 patients and audited their Family Practice Center and hospital charts for care received between July 1, 1994, and June 30, 1995. Cardiologists' office records were not reviewed. The following patient data were recorded from chart audits:

**Patient age and sex, and the month and year of CHF diagnosis.**

**Diagnostic criteria and NYHA classification.** Patients were evaluated to determine if they met the modified Framingham criteria for the diagnosis of CHF.<sup>14</sup> NYHA classification for CHF was determined by the patient's physician, and the most recent determination was used.

**Stage in the natural history of CHF when comanagement was initiated.** We defined 4 stages in the natural history of CHF. These stages were: I *Prediagnosis* — no signs or symptoms that meet diagnostic criteria for CHF; however, precipitating causes for CHF may have been identified, such as asymptomatic systolic dysfunction, coronary artery disease or myocardial infarction, hypertension, valvular heart disease, diabetes mellitus, or alcohol abuse; II *Diagnosis* — at the time when the diagnosis of CHF was made and diagnostic criteria for CHF were met; III *Progression* — from 1 month after the diagnosis until the patient reaches the fourth stage, a stage of declining function and progression of cardiac dysfunction; and IV *Terminal* — when the patient becomes NYHA class IV,

enters hospice care, or is on a transplant waiting list.

**Definition of comanagement relationship and the reasons for it.** Comanagement was defined as an ongoing relationship with a primary care physician and a cardiologist, characterized by a minimum of 1 visit to the cardiologist's office in the year of evaluation. Cardiologists regularly provided consultation letters to the primary care physician, and these were identified in the medical record. In addition, the primary care physician also mentioned patient visits to the cardiologist in their progress notes. A single hospital consultation without outpatient follow-up was not considered a comanagement relationship. The reason for initiating comanagement for each individual patient was classified as one of the following: (1) acuity and severity of CHF indicated by the presence of NYHA stage IV disease, cardiogenic shock, or for transplant evaluation; (2) a CHF-related diagnostic or therapeutic dilemma, such as evaluation of the etiology of CHF or assistance with titrating angiotensin-converting enzyme (ACE) inhibitor or beta-blocker therapy; (3) evaluation of other specific cardiovascular conditions, such as myocardial infarction or dysrhythmia; or (4) patient preference for comanagement clearly denoted in the absence of any of the other reasons. We initially considered the existence of a managed care guideline or recommendation as a reason for family physicians to initiate comanagement, but this was not a factor during the study period.

**Comorbid conditions.** Comorbid conditions were recorded, including a history of active treatment of chronic obstructive pulmonary disease, diabetes mellitus, stroke or claudication, depression, and hypertension; documented myocardial infarction by serial enzyme or electrocardiographic criteria; moderate to severe valvular heart disease by echocardiogram; left ventricular hypertrophy and atrial fibrillation by electrocardiographic criteria; renal insufficiency defined as a serum creatinine  $>1.5\text{mg/dL}$ ; current smoking status; or alcohol use of more than one drink per day.

**Documentation of left ventricular ejection fraction.** Echocardiography, radionuclide ventriculography, or cardiac catheterization reports were obtained from the patient's office record or hospital medical record. Left ventricular systolic ejection fraction was reported as normal, mild, moderate, and severe or as a percentage by the hospital's cardiology service. We defined a left ventricular ejection fraction of  $>45\%$  as normal systolic heart failure, 26% to 45% as intermediate systolic heart failure, and  $\leq 25\%$  as severe systolic heart failure. If a patient had more than one measure of left ventricular function, the most recent result was used in the analysis.

**Cardiac and selected medications.** The use of diuretics, ACE inhibitors, digoxin, calcium-channel blockers, aspirin, nitrates, beta blockers, Coumadin, dobutamine, hydralazine, amiodarone, and lipid-lowering medications was noted. The most recent cardiac and selected medication lists were used in the analysis.

**Selected outcomes.** We recorded the number of CHF-

or non-CHF-related emergency department visits and hospitalizations, and any deaths that occurred between July 1, 1994, and June 30, 1995.

## STATISTICAL ANALYSIS

For statistical comparisons, a *t* test or a Mantel-Haenzel chi-square test was performed as appropriate for bivariate analysis. Logistic regression analysis was used to evaluate the effect of comanagement status on the occurrence of hospitalization for CHF, after controlling for potential confounding variables. A forward stepwise method was used to evaluate potential confounding variables. Decisions involving whether to include a variable in the final model were made on the basis of the significance level of the Wald chi-square test for that variable and the amount of change in the parameter estimate for the main predictor (comanagement status) when the variable was added to the model. Potential confounding variables considered in the logistic regression analysis included patient age, sex, ejection fraction, comorbid conditions (ie, chronic obstructive pulmonary disease, coronary artery disease, atrial fibrillation, depression, renal insufficiency), smoking status, and whether the patient was taking an ACE inhibitor, a beta blocker, or digoxin. All statistical analyses were completed with SAS statistical software, version 6.12, on a personal computer.<sup>15</sup>

## RESULTS

### PATIENT CHARACTERISTICS

Approximately two thirds of the patients were managed solely by family physicians, and one third (36%) were comanaged with cardiologists (Table 1). Significantly more men were comanaged. They were also younger; 56% of patients managed solely by family physicians were older than 75 years compared with 35% of the comanaged patients. There was a comparable distribution of CHF patients according to NYHA classification for either management status. This contrasted with the distribution of CHF patients according to left ventricular ejection fraction; the comanaged patients had significantly more reduced systolic function (70% of comanaged patients had a left ventricular ejection fraction of  $<45\%$  compared with only 46% of those who were not comanaged). There were no differences in the 2 groups with regard to the percentage of patients who were newly diagnosed in the year of study and in the length of time patients had been diagnosed with CHF. Nearly 75% of CHF patients who were comanaged had an established relationship with a cardiologist for at least 2.5 years.

### TIMING OF THE COMANAGEMENT RELATIONSHIP AND THE REASONS FOR COMANAGEMENT

Of the patients who were comanaged, 74% began the relationship with their cardiologist early in the natural history of CHF, either before diagnosis (20%) or at the time of

TABLE 1

**Characteristics of Patients with CHF Managed by Family Physicians Alone or Comanaged with Cardiologists**

Characteristic	Patients Treated by FP only, %	Comanaged Patients, %	P
No. patients	97	54	
Sex, % women	59.7	40.7	<.025
Mean age, years	75.0	68.9	<.005
Age in years, %			
<45	1.0	3.7	
46 to 55	8.2	7.4	
56 to 65	12.4	22.2	
66 to 75	22.7	31.5	
>75	55.7	35.2	
Ejection fraction, %			
>45	40.2	27.8	<.033
26-45	33.0	42.6	
≤25	13.4	27.8	
unknown	13.4	3.7	
NYHA classification, %			<.644
I	27.8	29.6	
II	28.9	22.2	
III	23.7	29.6	
IV	7.2	11.1	
unknown	12.4	7.4	
New diagnosis in last year, %	30.9	25.9	
Duration of CHF, months	34.2	31.6	

CHF denotes congestive heart failure; FP, family physician; NYHA, New York Heart Association.

diagnosis (54%). Only a small subset (2%) initiated a comanagement relationship in the terminal stage of CHF (Figure).

The reasons for comanagement during stage I were predominately for cardiovascular conditions, such as coronary artery disease, myocardial infarction, or dysrhythmias in patients who eventually developed CHF. In stages II and III the reasons for comanagement were evenly distributed between non-CHF cardiovascular conditions, diagnostic or therapeutic dilemmas, and the acuity or severity of the condition. No evidence was identified from the medical record to support patient preference as a reason for comanagement.

### COMORBID CONDITIONS

Patients who were comanaged with a cardiologist had a significantly higher frequency of myocardial infarctions and depression and a significantly lower frequency of cerebrovascular accidents compared with CHF patients managed by family physicians alone (Table 2). There was a trend toward more valvular heart disease as detected by echocardiography among patients managed by family physicians. There were no differences in the frequency of hypertension, chronic obstructive pulmonary disease, atrial fibrillation, diabetes mellitus, renal insufficiency, cur-

rent smoking, and alcohol use between the 2 groups.

### SELECTED MEDICATIONS

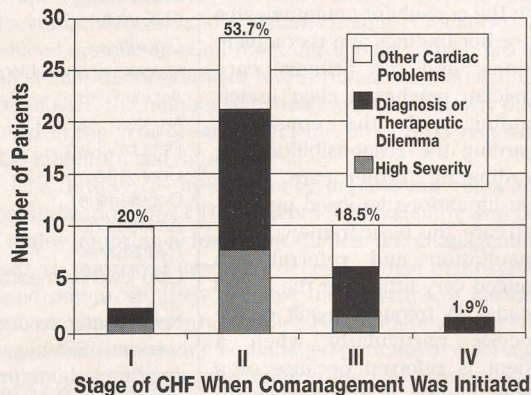
Patients who were comanaged were taking significantly more cardiac medications compared with patients who were managed by family physicians alone (mean = 4.6 vs 3.4). These cardiovascular medications included digoxin, calcium-channel blockers, nitrates, beta blockers, Coumadin, and lipid-lowering agents (Table 3). Diuretics and ACE inhibitors were used at the same frequency in both groups.

### EMERGENCY DEPARTMENT VISITS, HOSPITALIZATIONS, AND DEATHS

The frequency of emergency department visits and hospitalizations for CHF was significantly lower for patients with CHF who were comanaged compared with those who were managed solely by family physicians (Table 4). The difference between the 2 groups for emergency department visits and hospitalizations for CHF was seen only for patients with a prior history of ischemic heart disease. There was no difference in the frequency of non-CHF-related emergency department visits, hospitalizations, and deaths

between the 2 groups during the year of evaluation. Comanagement with a cardiologist remained a significant negative predictor (a protective factor) for CHF hospital-

FIGURE

**The reasons for comanagement as a function of the stage of CHF.**


CHF denotes congestive heart failure.

TABLE 2

## Comorbid Conditions in Patients with CHF Managed by Family Physicians or Comanaged with Cardiologists

Conditions	Patients Treated by FP only, %	Comanaged Patients, %	P
Hypertension	76	76	
Documented MI	46	74	<.001
Depression	28	48	<.012
Valvular disease by echocardiogram	33	20	<.085
Documented stroke or claudication	31	13	<.015
COPD	48	44	
Atrial fibrillation	30	39	
LVH by EKG	40	30	
Diabetes	30	28	
Renal insufficiency	31	26	
Current smoker	30	24	
Current alcohol use >1 drink per day	12	13	
No. of comorbid conditions, mean	4.5	4.9	

CHF denotes congestive heart failure; FP, family physician; MI, myocardial infarction; COPD, chronic obstructive pulmonary disease; LVH, left ventricular hypertrophy; EKG, electrocardiogram.

ization after adjusting for significant confounding variables in a logistic regression model (adjusted odds ratio = 0.25; 95% confidence interval, .09 - .96).

## DISCUSSION

The steps in the referral process that are important to rendering good medical care were outlined by T. Franklin Williams and his colleagues<sup>19</sup> in 1961: The primary care physician communicates the need and purpose for the referral to both the patient and consultant; the patient is evaluated by the consultant; the consultant communicates his or her findings and recommendations; and the primary care physician reaches a clear understanding with the consultant regarding the responsibilities for coordinating further care. Apart from limitations imposed by managed care, this basic framework for consultation and referral has changed very little over the past 3 decades. A frequent result of the process, particularly when a patient is referred because of a chronic illness, is a comanagement arrangement with ongoing involve-

ment by the primary care physician and the consulting physician. While the relative frequency of referrals to various specialty categories has been described, only a few studies have examined the frequency and outcomes of comanagement for specific chronic conditions.<sup>5,16,17</sup>

In our retrospective study, we determined that one third of the patients with CHF in our large community-based practice were in a comanagement relationship, and that comanagement generally began early in the natural history of CHF. More men were comanaged and they were typically younger, had more myocardial infarctions and reduced left ventricular ejection fractions, were on more cardiac medications, and had fewer emergency room visits and hospitalizations than patients who were managed solely by family physicians. The retrospective design of this study precludes any firm conclusions about a causal relationship between comanagement and clinical outcomes. However, the description of the timing and circumstances of

referral, the characteristics of the patients referred, and differences in resource utilization all raise interesting questions for further study regarding the effectiveness and appropriate use of a comanagement strategy for patients with CHF.

To define the timing of the comanagement relationship

TABLE 3

## Medications Used to Treat CHF in Patients Managed by Family Physicians or Comanaged with Cardiologists

Medication	Patients Treated by FP only, %	Comanaged Patients, %	P
Diuretic	81	83	
ACE inhibitor	62	69	
Digoxin	39	67	<.001
Calcium channel blocker	34	54	<.02
Aspirin	7	46	
Nitrates	37	57	<.02
Beta blockers	13	26	<.05
Coumadin	7	33	<.001
Dobutamine	11	22	<.07
Amiodarone	1	4	
Hydralazine	3	0	
Lipid-lowering medications	5	15	<.043
No. of cardiac medications (mean + SEM)	3.4 + .2	4.6 + .2	<.0001

CHF denotes cardiac heart failure; FP, family physician; ACE, angiotensin-converting enzyme; SEM, standard error of the mean.

TABLE 4

**Patients Seen in the Emergency Department or Hospitalized for Congestive Heart Failure and Mortality**

Outcome	Patients Treated by FP only, %	Comanaged Patients, %	P
Non-CHF-related visits to ED	35	40	
CHF-related visits to ED	54	33	<.013
for patients without CAD	43	27	
for patients with CAD	66	35	<.025
Non-CHF-related hospitalizations	32	32	
CHF-related hospitalizations	55	40	<.01
for patients without CAD	44	27	
for patients with CAD	68	43	<.025
Deaths in the past year	10	13	

FP denotes family physician; CHF, congestive heart failure; ED, emergency department; CAD, coronary artery disease.

for patients with CHF, we described 4 stages in the natural history of CHF. Many of the patients who were comanaged, however, had a cardiologist involved before the development of CHF for other cardiac reasons, or at the time of diagnosis. The early involvement by the cardiologist as demonstrated in this study could allow for management decisions that would optimize treatment and could influence the natural history of the condition and specific outcomes. In addition, having a second physician monitoring a patient in between visits to the family physician would allow additional opportunity to detect deterioration of a patient's status and institute earlier corrective measures. This could influence patient outcomes. The small number of patients in this study for whom comanagement was initiated in the later stages of CHF did not allow for subgroup analysis to determine if timing of comanagement was related to individual patient outcome. Our definitions of the stages in CHF would be useful in a study designed to answer this question.

### THE DECISION TO COMANAGE

Our results suggest that the most common reason a family physician initiated comanagement with a cardiologist was to resolve a diagnostic or therapeutic dilemma, most often using a procedure that only the cardiologist could perform. Patient acuity was less of a factor in the decision to initiate comanagement. Patients who request a consultation with a cardiologist are likely to influence the family physician's decision to refer, but this dynamic may not be reflected in the medical record. Our study may have underestimated patient preference as an influence on the decision to comanage.

The decision to initiate a comanagement relationship is a complex process that varies with the individual patient, family physician, and cardiologist.<sup>18-20</sup> Multiple factors may lead to a decision to begin a comanagement relationship including patient factors (eg, patient preference, patient

need for reassurance, patient confidence in the family physician, number of comorbid conditions), condition specific factors (eg, type of CHF, severity of disease, rare underlying cause), family physician factors (eg, knowledge about CHF, confidence level with CHF patients, uncertainty thresholds for diagnosis and treatment, previous outcomes with cardiology referral), cardiologist factors (eg, procedural expertise, style of comanagement), and system-of-care factors (eg, managed care guidelines). The relative importance of these factors in the comanagement of CHF patients has not been evaluated and not all factors listed above were available for this study. Our

ability to determine the most probable reason for initiating comanagement retrospectively is limited because of the difficulty in identifying the complex interplay of the patients and physicians involved.

We explored many potential differences in patient characteristics between comanaged patients and those managed solely by family physicians. Multiple comparisons in this descriptive study increased the likelihood that some of the statistically significant differences occurred by chance. However, the differences we observed between these groups of patients raise a number of questions about how physicians decide to refer patients for comanagement and the ways in which comanagement influences treatment choices. In our study, the patients cared for solely by family physicians tended to be women, older, and less likely to have had a myocardial infarction. They also had better systolic function and were on fewer cardiac medications. The medications used less often in these patients were those for conditions that are more common in the comanaged group: hyperlipidemia, coronary artery disease (beta blockers, nitrates, and calcium-channel blockers), or reduced systolic ejection fraction (digoxin). The 2 groups had similar distributions of NYHA functional status, duration of CHF, the number of patients who were newly diagnosed in the year of study, and the proportion receiving ACE inhibitors and diuretics.

The differences in emergency department visits and hospitalizations for CHF patients are intriguing and are of major importance for future studies. If comanagement leads to improved care and decreased use of hospital-based resources, then the cost implications of cardiology comanagement are sizable. The tendency for fewer hospitalizations among comanaged patients in our study remained significant after controlling for differences in patient characteristics using logistic regression analysis. The adjusted odds ratio from our analysis, while statistically significant, may overestimate the protective effect

of comanagement on hospitalization occurrence.<sup>21</sup> A causal relationship cannot be assumed from these results because of the retrospective nature of the study and our inability to control for many other factors that may influence the relationship between comanagement and the need for hospital-based care.

Underlying the need for care in the emergency department and the acute care hospital is a complex web of factors specific to patients and physicians, many of which we were not able to measure in our study. Patients with CHF who have experienced a life-threatening myocardial infarction, such as the majority of the comanaged patients, may be more motivated to control risk factors and comply with treatment recommendations than those who have not had a myocardial infarction. Noncompliance with treatment and dietary recommendations are major contributors to hospital admission rates for patients with CHF.<sup>6,22</sup> Comanaged patients were more likely to have been treated for depression; these patients may have been identified as being at higher risk for mortality and were followed more closely.<sup>23</sup> The patients managed by family physicians, more of whom were older and women, may have had weaker social support that could have led to later presentation and delayed identification of problems. Cardiologists may have had a higher threshold for hospitalization of patients with CHF than family physicians. The patients who were comanaged were more likely to be taking beta blockers, which also could lead to decreased hospitalization.<sup>24,25</sup> Treatment effectiveness for patients with CHF with normal systolic function is not well defined.<sup>26</sup> Consequently these patients may not have been treated optimally when compared with comanaged patients with systolic dysfunction who are likely to receive proven therapies.<sup>7</sup> Patients in both groups were treated with ACE inhibitors at comparable frequencies, but the cardiologists may have pushed more aggressively toward effective target doses used in clinical trials.<sup>27,28,29</sup> Patient education regarding self-monitoring of CHF symptoms and when to seek care may have also differed between cardiologists and family physicians.

## LIMITATIONS

In this retrospective study we were not able to measure a number of factors that may explain the differences in outcomes. Our method only allowed for a broad classification of reasons for comanagement and did not identify additional contributing factors that were likely to influence a comanagement relationship and clinical outcomes. The study was also limited by not having access to the cardiologists' medical records to include patients who are managed solely by cardiologists. Because CHF is the potential outcome of all cardiovascular disease, some patients with significant underlying cardiovascular disease may establish care solely with a cardiologist before CHF symptoms develop. In addition, the generalizability of this study is limited by our focus on only one family practice setting. The pattern of care and decisions for referral may be dif-

ferent in residency teaching practices than in private community-based practices. Despite these limitations, this study provides the first description of comanagement of patients with CHF and raises important questions regarding the value of comanagement that can be more accurately addressed by well-designed prospective studies.

## CONCLUSIONS

The results of our study suggest that comanagement by a family physician and a cardiologist is a relatively common occurrence for patients with CHF and that the patients who are comanaged differ in terms of age, sex, left ventricular ejection fraction, history of myocardial infarction, medications used, and number of hospitalizations for CHF exacerbations. Because the costs of care for CHF patients are high, these results have implications for further study of the role of comanagement in reducing costs and improving care for patients with CHF. This study raises more questions than it answers. Some key questions include: Why are some patients with CHF comanaged while others are not? What strategies are best for monitoring the clinical course of the patient and identifying criteria for initial referral and ongoing comanagement? Should all CHF patients with ischemic heart disease be comanaged? Does cardiology comanagement lead to decreased resource utilization for all patients with CHF, including the older ones with normal systolic function? These and other questions deserve further study to determine the value of comanagement strategies in a time when the complexity of diagnosis and therapeutic options for CHF is expanding.

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## REFERENCES

1. Chao J, Galazka S, Stange K, Fedirko T. A prospective review system of nonurgent consultation requests in a family medicine residency practice. *Fam Med* 1993; 25:570-5.
2. Calman N, Hyman RB, Licht W. Variability in consultation rates and practitioner level of diagnostic certainty. *J Fam Pract* 1992; 35:31-8.
3. Hansen JP, Brown SE, Sullivan RJ, Muhlbaier LH. Factors related to an effective referral and consultation process. *J Fam Pract* 1982; 15:651-4.
4. Epstein RM. Communication between primary care physicians and consultants. *Arch Fam Med* 1995; 4:403.
5. Nutting PA, Franks P, Clancy CM. Referral and consultation in primary care: do we understand what we are doing? *J Fam Pract* 1992; 35:21-3.
6. Schocken DD, Arrieta MI, Leaverton PE. Prevalence and mortality rate of congestive heart failure in the United States. *J Am Coll Cardiol* 1992; 20:301-6.
7. Konstam MA, Dracup K, Baker DW, et al. Heart failure: evaluation and care of patients with left-ventricular systolic dysfunction. Clinical practice guideline no. 11 AHCPR publication no. 94-0612. Rockville, Md: Agency for Health Care Policy and Research, Public Health Service, US Department of Health and Human Services, 1994.

8. Vinson JM, Rich MW, Sperry JC, Shah AS, McNamara T. Early readmission of elderly patients with congestive heart failure. *J Am Geriatr Soc* 1990; 38:1290-5.
9. Greenfield S, Nelson EC, Zubkoff M, et al. Variations in resource utilization among medical specialties and systems of care. *JAMA* 1992; 267:1624-30.
10. Weinberger M, Oddone EZ, Henderson WG. Does increased access to primary care reduce hospital readmissions? *N Eng J Med* 1996; 334:1441-7.
11. Rich MW, Beckham V, Wittenberg C, Leven CL, Freedland KE, Carney RM. A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure. *N Eng J Med* 1995; 333:1190-5.
12. Crump WJ, Massengill P. Outpatient consultations from a family practice residency program: nine years experience. *J Am Board Fam Pract* 1988; 1:164-6.
13. Lawler FH, Purvis JR, Glenn JK, Clark D, Horner RD. Physician referrals from a rural family practice residency clinic: a pilot study. *Fam Pract Res J* 1990; 10:19-26.
14. Kleber FX, Niemoller L, Doering W. Impact of converting enzyme inhibition on progression of chronic heart failure: results of the Munich mild heart failure trial. *Br Heart J* 1992; 67:289-96.
15. SAS Institute Inc. SAS procedures guide, release 6.03 edition. Cary, NC: SAS Institute Inc, 1988.
16. Williams TF, White KL, Fleming WL, Greenberg BG. The referral process in medical care and the university clinic's role. *J Med Educ* 1961; 36:899-907.
17. Kisker CT, Strayer F, Wong K, et al. Health outcomes of a community-based therapy program for children with cancer—a shared-management approach. *Pediatrics* 1980; 66:900-6.
18. Katon W, Von Korff M, Lin E, et al. Collaborative management to achieve treatment guidelines: impact on depression in primary care. *JAMA* 1995; 273:1026-31.
19. Barnett BL Jr, Collins JJ Jr. A new look at the consultation continuum. *J Fam Pract* 1977; 5:665-71.
20. Ludke RL. An examination of the factors that influence patients' referral decision. *Med Care* 1982; 20:782-96.
21. Newton J, Hayes V, Hutchinson A. Factors influencing general practitioners' referral decisions. *Fam Pract* 1991; 8:308-13.
22. Sackett DL, Deeks JJ, Altman DG. Down with odds ratios! *Evidence Based Medicine* 1996; 1:164.
23. Ghali, JK, Kadakia S, Cooper R, Ferlinz J. Precipitating factors leading to decompensation of heart failure. Traits among urban blacks. *Arch Intern Med* 1988; 148:2013-16.
24. Frasure-Smith N, Lesperance F, Talajic M. Depression following myocardial infarction: impact on 6 month survival. *JAMA* 1993; 270:1819-25.
25. Chadda K, Goldstein S, Byington R, Curb JD. Effect of propranolol after acute myocardial infarction in patients with congestive heart failure. *Circulation* 1986; 73:503-10.
26. Australia/New Zealand Heart Failure Research Collaborative Group. Randomized, placebo-controlled trial of carvedilol in patients with congestive heart failure due to ischemic heart disease. *Lancet* 1997; 349:375-80.
27. Vasan RS, Benjamin EJ, Levy D. Congestive heart failure with normal left ventricular systolic function. Clinical approaches to the diagnosis and treatment of diastolic heart failure. *Arch Intern Med* 1996; 156:146-57.
28. Captopril-Digoxin Multicenter Research Group. Comparative effects of therapy with captopril and digoxin in patients with mild to moderate heart failure. *JAMA* 1988; 259:539-44.
29. SOLVD Investigators. Effect of enalapril on mortality and the development of heart failure in asymptomatic patients with reduced left ventricular ejection fractions. *N Engl J Med* 1992; 327:685-91.