

Team Management of Patients With Heart Failure A Statement for Healthcare Professionals From the Cardiovascular Nursing Council of the American Heart Association

Kathleen L. Grady, PhD, RN; Kathleen Dracup, DNSc, RN; Gemma Kennedy, PhD, RN;
Debra K. Moser, DNSc, RN; Mariann Piano, PhD, RN; Lynne Warner Stevenson, MD; James B. Young, MD

Heat failure is estimated to affect 4 to 5 million Americans, with 550 000 new cases reported annually.¹ In the past 3 decades, both the incidence and prevalence of heart failure have increased.¹⁻³ Factors that have contributed to this increase are the aging US population and improved survival rates in patients with cardiovascular disease due to advancements in diagnostic techniques and medical and surgical therapies.^{2,4-6} Heart failure is a chronic, progressive disease that is characterized by frequent hospital admissions and ultimately high mortality rates. Because of its high medical resource consumption, heart failure is the most costly cardiovascular illness in the United States.⁷

Advances in the treatment of heart failure and early intervention to prevent decompensation may delay disease progression and improve survival. After initial evaluation, further diagnostic testing, and implementation of standard medical therapy, outpatient management strategies focus on maintenance of patient stability. Patient counseling/education, promotion of compliance, and discharge planning may further contribute to clinical stability and improved patient outcomes. A variety of outpatient heart failure management programs have been implemented during the past decade. These programs may also contribute to improved heart failure patient outcomes, including decreased symptoms, improved quality of life, reduced rates of hospital admission, and decreased healthcare costs. The purpose of the present report was to examine current heart failure management strategies and programs and to provide recommendations regarding (1) the use of an integrated approach to care through systematic assessment and management, (2) counseling and education of patients, (3) promotion of patient compliance with the treatment regimen, and (4) facilitation of hospital discharge/implementation of outpatient models of healthcare delivery.

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Development of an Integrated Approach to Heart Failure Management

Pathophysiology and Definition of Heart Failure

The syndrome of heart failure is a result of complex interactions among molecular, endocrine, and biodynamic systems. There are several pathophysiological mechanisms that are involved in the progression of heart failure; however, cardiac remodeling is more than likely a central feature in the progression of heart failure (Table 1).⁸⁻¹⁰ We now recognize that many different injurious processes create altered pump performance and circulatory dynamics.⁸ Injury can range from ischemia to myocardial toxins to volume or pressure overload. It can also be linked to genetic causes such as familial cardiomyopathies or even sporadic mutations in sarcomeric proteins. Even though these conditions are linked to different inciting extracellular stimuli (eg, myocardial infarction is linked to ischemia, hypertension is linked to pressure), there appears to be a convergence point at which the myocardium undergoes significant structural remodeling, myocyte phenotype changes, and loss of contractile function.^{11,12}

Through the years, heart failure has been defined in many ways. In most definitions, secondary alterations in hemodynamics were emphasized, and often heart failure was defined as a circulatory disorder secondary to left ventricular dysfunction. Recently, clinicians have recognized the need to develop a more encompassing definition of heart failure. Specifically, this definition highlights the process of left ventricular remodeling and the cellular events linked to the remodeling process, such as myocyte hypertrophy, interstitial fibrosis, myocyte dropout, and changes in the genetic expression of specific cardiac cell and subcellular proteins.¹¹⁻¹⁷

It is also important to stress that heart failure should not be defined solely on the basis of the presence or absence of congestion but rather should include a broad spectrum of characteristics, such as acute or chronic, right-sided or left-sided, systolic or diastolic, and with or without compromised organ perfusion. Indeed, in the future, as insight increases into the pathophysiology of the syndrome, additional characteristics will be included that more precisely describe perturbations characteristic of each individual patient. It is likely that these adjectives will refer to many specific hormonal, humoral, or inflammatory aspects of the syndrome.¹⁷ Increased understanding of the pathophysiological processes and expanded definition of heart failure provide the basis for therapy that is directed at reducing symptoms, promoting clinical stability, and decreasing disease progression.

TABLE 1. Pathophysiology of Heart Failure: From Injury to a Clinical Syndrome

Initiating event
Myocardial injury
Ischemia
Toxins
Volume overload
Pressure overload
Genetic perturbation
Cardiac remodeling
Myocyte growth
Concentric hypertrophy
Eccentric hypertrophy
Interstitial fibrosis/matrix deposition
Reexpression of fetal proteins
Intrinsic myocyte dysfunction
Apoptosis
Clinical heart failure milieu
Change in left ventricular chamber size and shape
Pump performance altered
Systolic dysfunction
Diastolic dysfunction
Circulatory dynamics change
Metabolic abnormalities ensue
Symptoms develop
Physical findings appear

Patient Assessment and Management

By the time a patient is enrolled in a heart failure management program, the diagnosis of heart failure, the first decisions about diagnostic procedures, and the initiation of standard therapies have usually been completed. These are well detailed in guidelines for the evaluation and therapy of heart failure.^{18–20} The essence of chronic heart failure management lies in the systematic approach to serial assessment and response to changes in patient status, which can be classified into 6 major areas (Table 2).

The care team must remain alert to factors that may exacerbate underlying cardiac dysfunction (Table 2). These factors may be extensions of the original cause of heart failure, such as active ischemia/infarction, uncontrolled hypertension, or heavy alcohol consumption. Viral infections and pneumonias frequently trigger decompensation episodes that can usually be reversed but may require several weeks of close supervision. Atrial fibrillation, which can cause or result from worsening heart failure, warrants the restoration of sinus rhythm or vigilant control of ventricular rate during routine activity.²¹ Obesity represents both a primary cause and an aggravating factor for heart failure.

The major focus of routine outpatient evaluation of heart failure patients is on the circulatory status at rest and with exercise. The resting hemodynamic profile can be simplified into a 2×2 table (Table 3) according to the presence or absence of evidence of elevated filling pressures (“wet” or “dry”)²² and the adequacy or compromise of tissue perfusion

TABLE 2. Ongoing Assessment in Heart Failure

Cause of and contributing factors to left ventricular dysfunction
Original cause (eg, ischemia, alcohol)
Additional exacerbating factors (eg, tachycardia, anemia, infection, pulmonary emboli, obesity, excessive alcohol consumption, use of recreational drugs, use of nonsteroidal anti-inflammatory agents, thyroid disease)
Current circulatory status
Resting profile
Evidence of congestion (wet)
Evidence of hypoperfusion (cold)
Cardiovascular reserve: activity level, evidence of limitation
Potential to improve current status with adjustment of therapy
Therapy for fluid retention
Therapy for symptomatic hypotension
Related risks
Symptoms of dysrhythmias
Risk or symptoms for embolic events
Recurrent ischemic events
Defining goals for ongoing therapy
Establishment of clinical stability
Maintenance of clinical stability
Modulation of disease progression
ACE inhibitors at target doses as tolerated in conjunction with the total regimen
β -Blockers if indicated and tolerated
Aerobic exercise training
Behavioral, psychological, and social risks
Noncompliance and factors that contribute to it
Anxiety and depression
Social isolation
Patient preferences and end-of-life decisions

(“warm” or “cold”).²³ Orthopnea is the most sensitive and specific symptom of elevated filling pressures, and it tends to reliably parallel filling pressures in a given patient.²⁴ Nocturnal or exertional cough is often a dyspnea “equivalent.” Jugular venous distention provides the most sensitive sign of elevated resting filling pressures, whereas peripheral edema is present in some patients and rales is present in relatively few patients with chronically elevated filling pressures.²⁵ Elevated right-sided pressures (right atrial pressure >10 mm Hg) are reliable almost 80% of the time for the detection of elevated left-sided pressures (pulmonary capillary wedge pressure >22 mm Hg) in patients with a primary diagnosis of chronic heart failure.²⁶ Elevated right-sided pressures often do not reflect left-sided pressures in the presence of severe intrinsic pulmonary disease.

Individual patients generally have very reproducible patterns of symptoms and signs as filling pressures increase; these patterns should be documented and available to all on the care team. In the office, physical evidence of congestion is used to confirm symptoms of congestion, whereas over the telephone, more use is made of the concordance of increased symptoms with weight gain attributed to fluid. Although the

TABLE 3. Profile of Resting Hemodynamics

	No Congestion	Congestion
	“Warm and Dry”	“Wet and Warm”
Adequate perfusion	A Optimal profile: focus on prevention of disease progression and decompensation	B Diuresis with continuation of standard therapy
Critical hypoperfusion	L Limited further options for therapy	C Diuresis and redesign of regimen with other standard therapies

The letter L represents the group with low output without congestion. Patients frequently progress from profile A to profile B. When that occurs, profile C commonly occurs after profile B. For the less common profile of low output without congestion, the letter L was chosen rather than the letter D to avoid the implication that this profile necessarily follows profile C or is a less desirable profile than C. In fact, the prognosis of profile C may be worse than that of profile L.

severities of congestive symptoms may be comparable, clinical assessment should be directed to determine whether there is accompanying evidence of hypoperfusion (Table 3, profile C). Physical evidence of hypoperfusion includes narrow pulse pressure, cool extremities, and occasionally altered mentation, with supporting evidence sometimes provided by decreased serum sodium level and worsening renal function. Hypoperfusion is frequently difficult to identify through telephone contact but may be suspected when previously effective diuretic increases fail, visiting nurses report lower blood pressures, or patients describe increased lethargy.

The potential to effect rapid improvement in symptoms is assessed in relation to the evident circulatory status, with the goal of the restoration of profile A (Table 3). Most unplanned changes in outpatient therapy, particularly during telephone communication, are triggered by symptoms of fluid retention. Outpatients who have congestion with good perfusion (profile B) on standard therapy can generally be treated with a temporary increase in diuretics. For the patient who is of profile C (congestion with low perfusion, “wet and cold”), it often is not possible to achieve diuresis before an improvement in systemic and renal perfusion from intravenous therapy, followed by major redesign of the oral regimen.²²

Another common symptom that leads to telephone or clinic encounter is postural dizziness or weakness, which can reflect either excessive vasodilation or fluid loss. Abdominal complaints can result from hepatic congestion or primary intra-abdominal pathology. Perhaps the most challenging symptom to evaluate via telephone is general fatigue.

The interval history during chronic heart failure management should also include questions directed to the related risks of dysrhythmias and embolic events¹⁸; these include symptoms of palpitations, presyncope and syncope, and transient defects of vision, speech, sensation, or coordination. The development of atrial fibrillation should trigger the initiation of anticoagulation therapy, as well as rate control and consideration of cardioversion.²¹

Patients should be questioned regarding episodic shortness of breath, which may reflect anginal equivalents or exertional increases in filling pressures already elevated at baseline.

They may be reminded that either condition may respond to nitroglycerin taken to either relieve or prevent such symptoms. In addition to therapy for symptoms, patients with heart failure due to coronary artery disease should be reminded of the importance of secondary prevention with antiplatelet and lipid-lowering agents, because recurrent ischemic events are a major cause of complications and death in this population.

Definition of Goals of Therapy: Clinical Stability

As a patient is followed in a heart failure management program, there should be explicit assessment of a composite clinical stability. The degree of instability influences decisions regarding further medical therapy, such as drugs, referral back to a heart failure specialty program, and consideration of transplantation or investigational protocols. In addition, the components of both physiological and psychosocial stability influence the allocation of valuable personnel time for further education, frequent telephone calls, and home visits.

One of the most important components of stability (Table 4) is freedom from clinical congestion, defined as the absence of orthopnea, heart-related edema, recent increase in weight or diuretic dose after repeated adjustments, and jugular venous pressure of ≤ 8 cm.²⁷ Despite previous New York Heart Association (NYHA) functional class IV symptoms, patients able to achieve freedom from congestion had a 2-year survival period that approached that of NYHA functional class III patients.²⁸ Stable patients should appear to have adequate cardiac output at rest. In most cases, a systolic blood pressure of ≥ 80 mm Hg and a pulse pressure of $\geq 25\%$ suggest adequate cardiac output. Patients should in general be able to dress without stopping and to walk a city block. Other factors that suggest overall instability include major drug side effects likely to require the discontinuation of fundamental therapy, increasing anginal pattern, or recurrent symptomatic arrhythmias. Poor control of a concomitant disease such as emphysema or diabetes mellitus may also lead to a label of instability.

Psychosocial factors also contribute to clinical stability. Patients, often with reinforcement from their families or

TABLE 4. Suggested Criteria for Clinical Stability With Chronic Heart Failure

Clinical cardiovascular criteria	
	The same or improved activity since previous visit, generally walking ≥ 1 city block
	No limitation during dressing
	Freedom from evidence of congestion: absence of orthopnea, edema, ascites, or a jugular venous pressure of ≥ 8 mm Hg
	Angina absent or present in stable exertional pattern
	No syncope or other recurrent symptomatic arrhythmias
	Stable fluid balance with an increase in diuretic dose of not more often than once a week
	Stable vital signs
	Blood pressure
	Systolic heart failure: systolic pressure of ≥ 80 mm Hg, no symptoms of postural hypotension, and a proportional pulse pressure of $\geq 25\%$
	Heart failure with "preserved ejection fraction": control of hypertension
	Heart rate
	Sinus rhythm: generally ≤ 85 bpm at rest
	Atrial fibrillation: generally ≤ 85 bpm at rest, ≤ 110 bpm with routine activity
Stability of noncardiovascular disease (examples)	
	Control of pulmonary disease with lowest possible doses of systemic corticosteroids and inhaled β -adrenergic agents
	Control of hyperglycemia without hypoglycemia in patients with diabetes mellitus
	Effective therapy for gastrointestinal blood loss or iron deficiency anemia
Laboratory criteria	
	Stable renal function, generally with serum creatinine of ≤ 2.0 mg/dL and blood urea nitrogen of ≤ 50 mg/dL; may be higher in patients with known intrinsic renal disease
	Stable serum sodium, generally >134 mEq/L
Psychosocial criteria	
	Compliance with medical regimen
	Medications
	Salt restriction
	Fluid restriction, if needed
	Daily weights and flexible diuretic regimen
	Social support
	Absence of serious depression or dementia

companions, should understand the disease, medications, and the aspects of fluid balance, which consist of salt restriction for all patients, fluid limitation in patients with high diuretic requirement, daily weight measurements, and the flexible diuretic regimen for weight gain. Patients must be able to recognize warning signs of decompensation and to seek help before the situation becomes emergent. Other vital factors are the adequacy of social support and financial resources for medications, diet, and transportation. Psychiatric disorders can compromise compliance and the loyalty of support people. Depression, both reactive and intrinsic, is common and is associated with worse outcomes in heart failure.²⁹

Some patients never achieve all components of clinical stability. When this failure to achieve stability is due to persistent NYHA class III/IV symptoms and frequent hospitalizations, referral or return to a heart failure specialty program is often considered, if not previously made.³⁰ Once in a heart failure specialty program, patients may be reevaluated for further redesign of medical therapy with combinations of effective agents, procedural intervention to treat ischemia or valvular disease, potential heart transplantation, or investigational protocols. When this failure to achieve stability is due to noncompliance, the enlistment of further ancillary social support both in and outside of the family may be appropriate. It is often difficult to decide how much of the limited personnel resources of a disease management program should be devoted to repeated education attempts after recurring failure of compliance with medications, of abstinence from alcohol and recreational drugs, of observance of salt and fluid restriction, or of routine follow-up. Patients with serious depression or other psychiatric components of instability often require ongoing psychiatric consultation.

When patients demonstrate stability in most components, further therapy is directed toward the longer-range goal of decreased disease progression.²⁰ Are patients receiving optimal doses of ACE inhibitors? If ACE inhibitors previously led to symptomatic hypotension in an unstable patient, can the drugs be retested in a setting of stability? The patient who has never deteriorated or who has reestablished freedom from congestion should be considered for careful titration of therapy with β -adrenergic-blocking agents.²⁰ An exercise program should be initiated or advanced as appropriate.³¹ Once the medication regimens for both symptomatic relief and long-term stability are established, there is less need for frequent ongoing evaluation through home nursing visits, office visits, or scheduled telephone contact. Graduation to clinical stability for many patients means the decreased need for intense follow-up, after a review of symptoms and signs for which patients should contact their care team. Although the intervals between contact increase, it is important to establish a schedule of telephone communication and office visits to maintain patient compliance and to allow response to clinical changes before they lead to hospitalization.

Last, patient preferences and end-of-life decisions should be discussed with patients given that the average 1-year mortality rate for heart failure is 10%,³² one half of all deaths will be sudden, and as many as 25% of deaths will occur without significant worsening of heart failure.³³ All patients should be encouraged to complete some form of advance directive. Family members may choose to learn cardiopulmonary resuscitation techniques, but such training should be combined with a discussion about the potential burden of living with someone at risk for sudden death.³⁴ The inclusion of counseling with cardiopulmonary resuscitation training may assist family members to better understand the risks of sudden death and to better cope with their family member's illness.³⁴ In addition, studies have been conducted regarding the training of family members of patients at high risk for sudden death in the use of external automatic defibrillators.³⁵ Data from these studies are controversial and do not yet

TABLE 5. Suggested Topics for Education and Counseling

General topics
Explanation of heart failure
Expected symptoms vs symptoms of worsening heart failure
Psychological responses
Self-monitoring with daily weights
Action plan in case of increased symptoms
Prognosis
Advanced directives
Dietary recommendations
Sodium restriction
Fluid restriction
Alcohol restriction
Compliance strategies
Activity and exercise
Work and leisure activities
Exercise program
Sexual activity
Compliance strategies
Medications
Nature of each drug and dosing and side effects
Coping with a complicated regimen
Compliance strategies
Cost issues

support widespread training of family members.³⁵ Further research is warranted.

Education and Counseling

Education and counseling of the patient with heart failure are essential aspects of patient care that promote clinical stability. The fundamental impact of education and counseling on positive outcomes for patients with heart failure was underscored in a recent study by Serxner et al.³⁶ In an intervention notable for lack of contact with a healthcare provider, these investigators tested the impact of serial mailings of educational materials on readmission rates, compliance, and costs. The educational materials were personalized; self-care was emphasized, and recommended health behaviors were promoted. The materials were mailed to patients in the intervention group 4 times at 3-week intervals for a total of 12 weeks. Compared with the usual-care control group, patients who received the mailed materials demonstrated a 51% reduction in total admissions and reduced costs and reported better compliance with weighing and following a low-salt diet.

A clear and organized plan of patient education and counseling is critical to the achievement of optimal outcomes (Table 5). Overviews of heart failure and associated symptoms, dietary recommendations, activity and exercise, and medications are taught to patients and families. Given the complexity of the information, the team approach is extremely useful in helping patients to understand and retain information about the treatment regimen.^{30,37} Physicians, advanced practice nurses, home health nurses, dietitians, and pharmacists all play important roles in this process. Written

materials and videotapes are an additional invaluable resource for patient education but should serve as adjuncts to and not as replacements for one-on-one education.

Understanding the Symptoms of Heart Failure

An important place to begin teaching is a clear, understandable, and simple explanation of the pathophysiology of heart failure. Many patients do not understand the term “heart failure” and assume that it means that the heart has permanently failed, signifying death. The term must be explained with care, emphasizing that it is a decrease in the reserve power of the heart as a pump. This can limit the ability of the patient to perform some vigorous activities. For most patients, flow at rest and during routine activities of daily living is at normal or near-normal levels.

A clarification between expected symptoms of heart failure and symptoms of worsening failure is important. Patients must understand that progressive dyspnea on exertion or a sudden change in orthopnea or paroxysmal nocturnal dyspnea is not expected. Patients should be instructed to notify their healthcare provider immediately when they experience symptoms of worsening failure to prevent unnecessary hospitalizations or complications. In 2 recent investigations, the inability of heart failure patients to recognize early signs of worsening heart failure delayed their seeking and obtaining appropriate medical therapy.^{38,39}

A goal of self-management is to have patients understand the role of fluid retention in worsening symptoms and be able to seek care early, thereby avoiding hospitalization. In a retrospective review of 585 hospital admissions for heart failure, 346 (59%) were attributed to excessive sodium retention that led to volume overload.⁴⁰ Patients should be instructed to obtain a bathroom scale and to weigh themselves each morning (after urination and before eating). If their weight changes by >2 to 3 lb since their last clinical evaluation, they should notify their healthcare provider. In some patients, a diuretic regimen that the patient adjusts on the basis of daily weight can be extremely useful. For example, if the patient gains >2 to 3 lb within 1 to 2 days and is already taking a loop diuretic, he or she might double the dose of the loop diuretic or add a small dose of metolazone (2.5 or 5 mg), with appropriate electrolyte replacement, until he or she returns to the baseline weight. Initially, close communication between the patient and healthcare provider about dosage adjustments is essential if self-management is to be effective. Teaching patients to adjust their diuretic dose on the basis of specified changes in daily weight has been successful in some programs.^{30,41} If patients or their family/caregiver is unable or unwilling to assume this degree of responsibility, alternatives include home visits by a nurse to administer a diuretic or “drop-in” visits by the patient to a heart failure clinic or physician’s office.

Dietary Recommendations

A 2-g sodium diet is frequently recommended. However, no studies have been conducted to evaluate specific recommendations related to sodium restriction.⁴² A 2-g sodium diet is unpalatable for some patients, whereas a 3-g sodium diet may be a more realistic target for patients with mild to moderate

heart failure. It can be achieved by avoiding salty foods (eg, canned or frozen foods) and by not adding salt to foods after cooking. If patients require large doses of diuretics to prevent fluid retention, sodium intake will have to be more severely restricted, which requires the careful reading of food labels. Dietary instruction must take into account ethnic preferences and may require individualized counseling by a dietitian.

Similarly, patients who require large doses of diuretics or who have hyponatremia may also have to restrict their fluids to ≤ 2 L/d. Anecdotally, a significant number of patients with heart failure are under the misperception that taking diuretics requires "flushing the kidneys" with large amounts of fluids; this misperception should be quickly corrected. For some patients, fluid restrictions are difficult to follow because of excessive thirst related to decreased cardiac output. Suggestions for satisfying their thirst with sugarless hard candy or ice chips may prove helpful.

Alcohol is usually prohibited because its acute ingestion depresses myocardial contractility in patients with known cardiac disease.⁴³ However, no studies of the effect of moderate ingestion of alcohol on functional status or death have been conducted. In general, alcohol use should be discouraged and should be prohibited for patients with alcohol-induced cardiomyopathy.

Other dietary restrictions should be discouraged unless clearly indicated (eg, a low-fat, low-cholesterol diet for hypercholesterolemia in patients with ischemic cardiomyopathy or a reduced-calorie diet for obese patients). Although some heart failure patients are obese, other patients with advanced heart failure experience a syndrome of chronic wasting, which can be exacerbated by unnecessary dietary restrictions. Frequent, small meals may combat the effect of anorexia caused by congestion of the gastrointestinal tract.

Activity and Exercise

Given current evidence,⁴⁴ patients should be encouraged to stay as active as possible, including sexual activity and a moderate exercise regimen. After many years of restricting patients with heart failure from aerobic exercise, researchers have demonstrated that aerobic exercise training in patients results in improved exercise duration, less fatigue, faster pace of activities, and improved general well-being.⁴⁵⁻⁴⁷ To date, there are no data on the benefit or harm of a strength or resistance exercise program. Given the threat of complications related to increased myocardial oxygen demand in the face of isometric exercise,⁴⁸ patients are usually counseled to avoid lifting a significant weight (eg, >20 lb) or performing exercises that cause a patient to strain (eg, performing a Valsalva maneuver).

Sexual problems are well documented and should be carefully assessed by the practitioner.⁴⁹ Fears about physical exertion or symptoms may contribute unnecessarily to sexual difficulties. Sexual practices may have to be modified to accommodate patients with limited exercise tolerance, and practitioners should be proactive in raising this topic to avoid unnecessary anxiety on the part of the patient or partner.

Medications

Patients should be taught the name of each drug and its purpose, dosage, frequency, and significant side effects.⁴² For

example, patients who take β -blockers should be told that they may experience fatigue, lightheadedness, or dizziness.^{50,51} They should be further instructed that the β -blocker will be up-titrated slowly, as tolerated; that side effects will decrease over time; and that they should call the healthcare team if they experience any adverse effects. Patients who are not properly instructed about the purpose and side effects of β -blockers may stop taking this medication because they think that their heart failure has worsened. Patients should also, however, be instructed that the rapid onset of severe disabling weakness during the initiation of β -blocker therapy remains an indication to seek urgent medical attention.

In addition, patients should be instructed to bring all of their medications with them to each office visit. This serves 2 purposes. First, information about each drug can be reviewed, and the patient's knowledge can be assessed. Second, the practitioner can identify omissions, duplications, confusion about drug doses, and drug interactions. In addition, patients should be asked about over-the-counter and alternative medications (eg, homeopathic or herbal products) they may be taking. Alternative medications should not be taken without first consulting the healthcare team, and nonsteroidal anti-inflammatory drugs should be avoided completely because they can lead to renal dysfunction and renal failure.

A written medication schedule is strongly recommended for complicated medication regimens to reduce the adverse affect of polypharmacy on patients' daily lives, patient compliance, and the potential for drug interactions. If the regimen is complex, the practitioner should review it to determine whether medications can be changed to single-dose medications. For example, some patients who require nitrates may be able to take isosorbide mononitrate once daily instead of isosorbide dinitrate 3 or 4 times daily. Patient histories should include an assessment of the degree to which medications are disruptive to a patient. Medication schedules can then be constructed to minimize their impact on patients' daily activities and sleep schedules. For example, patients can be instructed to take their second dose of a twice-daily diuretic earlier in the day so as not to interfere with sleep. A medication schedule may also minimize the potential for drug interactions. For example, patients who are taking 2 vasoactive agents may have to be instructed to take these 2 medications at least 2 hours apart, because both can contribute to hypotension. A written medication schedule is also useful if the patient requires sudden hospitalization. In addition, a diary may provide a means to record vital signs (as needed), weight, fluid intake, or adverse events.

The goals of education and counseling are to assist patients in compliance with the therapeutic regimen, to maintain clinical stability and function, and to improve quality of life. These goals are best achieved when the patient and family are knowledgeable about every aspect of the condition and treatment and are active participants in the plan of care.

Compliance With the Therapeutic Plan of Care

The implementation of a successful therapeutic plan of care for patients with end-stage heart failure is dependent on

patient participation and compliance with the treatment regimen to adequately evaluate the efficacy of the plan and to recommend ongoing strategies for care (Table 5). Strategies to enhance patient compliance must therefore be an integral part of the overall management plan. These strategies not only must include the patient but also must integrate the roles of physicians, nurses, other healthcare providers, and healthcare organizations into the plan to ultimately improve patient outcomes.⁵²

Research related to compliance by the patient with heart failure at the patient, provider, and healthcare system levels is limited because of the difficulty involved in the measurement of compliance at all 3 levels. Some studies have examined patient-related factors, such as lack of compliance with dietary restrictions and medications, that contribute to worsening heart failure and hospital readmission.^{40,53–57} Noncompliance with heart failure treatment plans was found to be common and appeared to increase as heart failure progressed.^{53,54,56,58} Ghali et al⁵³ reported that an urban black population of patients with heart failure were hospitalized an average of 3 times per year due to heart failure. The major cause, which was present in 64% of cases, was lack of compliance with prescribed medication or diet plans. Vinson et al⁵⁴ studied readmissions for elderly patients hospitalized with documented heart failure and discovered that as many as 53% of readmissions may have been prevented. Noncompliance with medication and diet therapy was a major cause of heart failure exacerbation in this sample. Among 7247 elderly heart failure patients on digoxin who were followed for 1 year, only 10% were compliant with their prescription.⁵⁶ Sodium and volume overload, due in many cases to medication and dietary noncompliance, was a factor in 55% of readmissions for heart failure in a recent study at 2 large Midwest hospitals.⁴⁰

There are many reasons that patients may not comply with a therapeutic regimen. Lack of knowledge, poor motivation, decreased understanding, lower perceived self-efficacy, forgetfulness, and decreased support from family and other caregivers have been identified as factors that contribute to noncompliance.^{40,55,57,59–61} A patient may not comply with a prescribed regimen because he or she is unconvinced of the benefits of doing so or because he or she perceives that the side effects or inconveniences of following the regimen outweigh any benefits. If cost is a factor in noncompliance, suggestions for lower-cost medications or financial assistance programs should be provided.

The provision to patients and their families/caregivers of behavioral strategies to increase adherence is vital. There are many strategies to assist patients to comply with their heart failure regimen, such as the use of a daily reminder routine, filling a pill box that contains 1 week's medications, the implementation of incremental monitoring by caregivers, the use of medication information and reminder cards, and counseling.⁶²

Healthcare providers can also contribute to heart failure patient noncompliance and rehospitalization. Impediments to patient compliance include advising changes that disregard the patient's current lifestyle and failing to counsel or advise patients on how to adapt their current lifestyle to accommo-

date recommended changes.⁶³ Healthcare providers may also make recommendations without detailing how to implement the recommendations. For example, clinicians may fail to adequately educate and counsel the patient or support person who may be responsible for purchasing food, cooking, and administering medications. Another important factor that contributes to patient noncompliance and rehospitalization for worsening heart failure is inadequate discharge planning and follow-up after discharge.⁵⁴

The management of heart failure in elderly persons is often made more challenging by the presence of multiple coexisting problems.³⁷ These factors contribute to the increased vulnerability of elderly patients to noncompliance and rehospitalizations for heart failure and include (1) the presence of comorbidities such as diabetes, chronic lung disease, and stroke; (2) polypharmacy; (3) financial concerns; (4) physical and cognitive limitations; (5) inadequate social support and social isolation; and (6) depression and anxiety. Clinicians who do not consider these factors when caring for elderly heart failure patients can contribute to patient noncompliance.

A few studies have examined the role of healthcare provider compliance with heart failure practice guidelines and the impact on patient outcomes.^{30,64–66} Despite the publication of consensus guidelines^{42,67} that established standards for heart failure medical therapy, many patients are still not prescribed ACE inhibitors, do not receive them in adequate doses, and are prescribed drugs that may have deleterious effects on heart failure.⁶⁸ The use of ACE inhibitors for the treatment of heart failure in the community setting has increased from the early to mid 1990s, but the use has remained below recommendations in practice guidelines.^{64,65} Furthermore, more cardiologists than noncardiologists were found to conform to published guidelines (Agency for Health Care Policy and Research guidelines⁴²) for the management of heart failure patients.⁶⁵ Specifically, more cardiologists than generalists were likely to use ACE inhibitors for the treatment of mild, moderate, and severe heart failure and to titrate to doses proved to be efficacious in clinical trials.⁶⁵ Other studies have found that patients who were referred to heart failure specialists had fewer hospitalizations^{30,37,66} and were more functional^{30,66} than they were before the referral.

To date, no investigators have addressed the role of healthcare organizations in the achievement of heart failure patient compliance with therapeutic regimens. To improve the compliance of heart failure patients, it is necessary to identify variables that affect compliance at the patient, provider, and healthcare system levels and to develop strategies to improve, monitor, and sustain compliance at all 3 levels. The promotion of patient compliance begins with discharge planning.

Hospital Discharge and Outpatient Heart Failure Management Programs

Hospital Discharge

The facilitation of a heart failure patient's successful transition into the outpatient setting begins in the hospital with the

implementation of discharge planning. A successful transition can be achieved through a focused, comprehensive, multidisciplinary discharge plan that begins immediately after admission and is reevaluated at multiple times during the patient's hospitalization.⁶⁹ The patient and family are important members of the multidisciplinary discharge planning team. Vinson et al⁵⁴ reported that inadequate discharge planning and follow-up were leading factors associated with the readmission of heart failure patients within 90 days of discharge. These authors defined inadequate discharge planning as "failure to involve social services and other ancillary support staff" and defined inadequate follow-up as "failure to involve home care or caregiver and inattention to follow-up visits."

In a prospective, randomized clinical trial, Naylor et al⁶⁹ found marked reductions in the hospital readmission rates of elderly patients after a comprehensive, multidisciplinary discharge planning program. Based on the results of Naylor et al,⁶⁹ discharge planning should be initiated within 24 to 48 hours after hospital admission. Discharge planning should include gathering information related to sociodemographics (including the home environment and financial resources for medical care); patient use of health and social services before hospitalization; general health, functional, mental, and emotional status; knowledge of heart failure and related self-care; prehospitalization compliance with a healthcare regimen; and patient and caregiver needs and expectations at discharge. After the initial evaluation, a summary plan is drafted, components of the plan are implemented, and the plan is reevaluated regularly during hospitalization.

Discharge planning also includes an assessment of the need and subsequent plan for outpatient follow-up, which will vary from patient to patient. Some heart failure patients simply require follow-up at regularly scheduled clinic visits, whereas others require additional follow-up via telephone or home visits. Patients who demonstrate, either initially or subsequently, favorable clinical and psychosocial profiles will require less intensive follow-up to maximize outcomes. Other patients may require and will benefit from more intensive follow-up, and still others will require high-level follow-up but may not do well in any setting. Therefore, patient needs must be identified early so that resources can be allocated appropriately. Communication of the patient's status and the plan of care to outpatient nurse coordinators and home health nurses at the time of discharge is critical to the implementation of a successful discharge plan.

Actual patient discharge typically occurs when patients have decreased symptoms, an improved hemodynamic profile, and clinical stability within the current limits of their cardiac dysfunction. The goal at the time of discharge is for the patient to not only have achieved hemodynamic stability (profile A if possible; Table 3) but also be on a regimen that is likely to maintain stability after discharge. This may be accomplished during hospitalization via temporary intravenous therapy or the redesign of the oral therapy regimen. Ongoing assessment of clinical stability after discharge, as described in Table 4 and discussed previously, is essential to reduce readmission rates.

Last, factors associated with a greater risk of heart failure exacerbation and hospital readmission must be identified.

Krumholz et al⁷⁰ found the following factors to be significantly related to increased rates of readmission: male sex, at least 1 prior admission within 6 months of the index admission, the presence of >1 comorbidity, and a length of stay in the index hospitalization of >7 days. (In this study, index hospitalization referred to a random single hospital admission for the patient; prior admissions were admissions that occurred in the 6 months that preceded the index admission.) Identification of these high-risk patients at discharge and monitoring of them more closely in the home setting may decrease the risk of rehospitalization. With the development of an individualized discharge plan, full participation of patients and their family in the plan, and communication of the plan to the outpatient team, the potential for improved patient outcomes after discharge can be realized.

Outpatient Heart Failure Management Programs

There is considerable diversity among outpatient heart failure management programs. These programs were designed and implemented primarily to reduce rehospitalization rates and associated costs. In most programs, an improvement in quality of life also was a major goal.

In the majority of studies, outcomes after institution of the program were compared with those before institution of the intervention.^{30,41,66,71-74} Fewer investigators used randomized controlled trials to test the outcomes of their programs.^{37,62,75-78} Although there is some overlap, the programs studied can be classified as follows: (1) specialty heart failure clinics,^{30,41,66,71,75} (2) specialty heart failure care outside the clinic setting that involves community outreach,^{37,62,72-74,76,78} and (3) increased access to primary care.⁷⁷ In each of these programs, nurses played an integral role, and their contributions were as either managers/directors of care^{37,41,71,74-78} or coordinators/facilitators of care.^{30,62,66,72,79}

Specialty Heart Failure Clinics

In the heart failure clinic model, care is delivered in an outpatient setting by practitioners with heart failure expertise to patients who attend the clinic. In some cases, 1 or more members of the program team deliver care while the patient is still in the hospital, but the primary site of care delivery is an outpatient clinic. In nurse-coordinated or -facilitated models, the nurse assists cardiologists in coordinating or facilitating care. In nurse-managed or -directed care, a nurse, usually an advanced practice nurse, has primary responsibility for the day-to-day care of patients.

Nurse-Coordinated/Facilitated Care

The Heart Failure and Heart Transplant Program at Vanderbilt University Medical Center is a physician-directed clinic in which nurse coordinators assist with patient management. In studying this service, Hanumanthu et al⁶⁶ compared outcomes before and after referral to the program in 134 patients (71% were men, mean age 52±12 years). The program consisted of long-term follow-up by 3 physicians and 2 nurse coordinators whose practice was dedicated to the care of heart failure patients. The members of this team managed care for patients referred to the program both in the hospital and after discharge. They met periodically to integrate care with the local hospice and home health agencies.

Outcomes after referral to the program were compared with those before referral for patients followed >30 days. After referral to the program, patients' functional status, as indicated by peak $\dot{V}O_2$, improved, as did quality of life as measured with the Minnesota Living With Heart Failure Questionnaire.⁸⁰ Rehospitalizations decreased by 53%.

Fonarow et al,³⁰ at the University of California, Los Angeles Medical Center, studied 214 patients (81% were men, mean age 52 ± 10 years) after referral to their heart failure program for heart transplant evaluation. Patients referred to the program were managed as inpatients and outpatients and followed after discharge by cardiologists with heart failure expertise and by heart failure clinical nurse specialists. Pharmacological therapy was optimized with hemodynamic monitoring, and patients received comprehensive education and counseling. Compared with 6 months before referral to the program, patients demonstrated an 85% reduction in rehospitalizations and demonstrated improved functional status as indicated with NYHA functional classification and peak oxygen consumption. The estimated cost savings for the reduction in rehospitalizations was \$9800 per patient.

Nurse-Managed/Directed Care

Cintron et al⁷¹ were the first clinicians to report outcomes from a heart failure clinic. This study was unique in 2 aspects. First, these clinicians saw the need for specialty heart failure care more than a decade before most others began reporting outcomes from specialty heart failure care. Second, the heart failure clinic was managed by nurse practitioners. In this study, 15 NYHA functional class III/IV chronic heart failure patients (100% were men, mean age 65 years) were followed after referral from the in-hospital service or outpatient clinics at the San Juan Veterans Administration Hospital. Patients were referred after evaluation and stabilization with therapy recommendations from Veterans Administration cardiologists. Care consisted of follow-up assessment visits every 3 weeks in the clinic with a mean follow-up of 24 months. Patient education was emphasized at each visit, as was assessment of home problems and family support. The clinic also featured increased availability; the nurse practitioner was available on a "walk-in" basis for patients. Nurse practitioners consulted a cardiologist when necessary. After an average follow-up of 12 months, there was a 60% reduction in rehospitalizations and an 85% reduction in number of hospital days. Costs for outpatient care increased by 200% but were offset by decreased inpatient care costs, for a 75% net reduction in total medical costs. Patients reported satisfaction with the clinic; all patients preferred it and believed they received better care than they had with the regular staff clinic.

Outcomes among 21 consecutive heart failure patients (100% were men, mean age 61 years) who were referred to the Cardiomyopathy Clinic at the Veterans Administration Medical Center were examined by Smith et al.⁴¹ These investigators compared NYHA functional class, exercise time, peak oxygen consumption, quality of life as measured with the Minnesota Living With Heart Failure Questionnaire, rehospitalizations, and emergency department visits 6 months before and after referral to the clinic. In this clinic, either a

heart failure cardiologist or a nurse practitioner provided care. The nurse practitioner was available by telephone for patient questions. Compared with before referral to the clinic, more patients were prescribed ACE inhibitors and at higher doses. Doses of diuretics also increased. After referral, patients exhibited improved NYHA functional class and quality-of-life scores, increased exercise time, and an 80% decrease in emergency department visits and rehospitalizations.

In a report of a Swedish experience with a heart failure specialty clinic, Cline et al⁷⁵ randomly assigned 190 patients (52.3% were men, mean age 75.6 ± 5.3 years) to either usual care or the outpatient clinic program. Patients randomized to the clinic received (1) hospital and outpatient education on heart failure and pharmacological and nonpharmacological aspects of its treatment, (2) medication organizers, (3) instructions for a flexible patient-managed diuretic regimen, (4) a 1-hour information visit at home after discharge, and (5) referral to an easy-access, nurse-directed outpatient clinic with instructions to contact nurses for any problems or concerns. Patients assigned to the clinic group demonstrated a 33% longer time period to first hospital readmission than patients in the control group. In addition, patients in the clinic group experienced no increase in the number of days they were hospitalized compared with the 12-month period preceding their assignment to the intervention. Patients in the control group experienced a 59% increase in the number of days hospitalized. Clinic patients also exhibited nonsignificant trends toward fewer rehospitalizations (36%) and lower healthcare costs.

Community Outreach

In specialty heart failure care outside the clinic setting that involves community outreach, care is delivered primarily in patients' homes. Patients do not routinely go to a clinic or other outpatient setting to receive care; rather, the healthcare provider calls on the telephone or comes to the home.

Nurse-Coordinated/Facilitated Care

Kornowski et al⁷² reported outcomes from an intensive home care program in Israel for NYHA functional class III/IV heart failure patients >65 years old. They studied outcomes in 42 patients (57% were men, mean age 78 ± 8 years). The program consisted of weekly home visits from a physician with a specialty in internal medicine and from a nurse, during which patients' conditions were assessed, medications were reviewed and any necessary changes were made, laboratory tests were run, and intravenous diuretics were administered as needed. Patients could call their physician for problems, and the physician would make an extra home visit if necessary. Patients were followed for 12 months, and outcomes at 12 months before and after the program were compared. After the program, patients demonstrated a 62% reduction in the number of total rehospitalizations and a 77% reduction in associated hospital days, a 72% reduction in hospitalizations for cardiovascular causes and an 83% reduction in associated hospital days, and a significant improvement in functional status as assessed by a physician regarding the patients' ability to perform daily activities.

A nurse-and-pharmacist team provided care for 97 heart failure patients (49% were men, mean age 75 years) in an

Australian study of a home-based intervention.⁶² With the use of a randomized controlled trial design, patients were assigned to either the home-based nurse-and-pharmacist intervention or usual care. The home-based program consisted of an in-hospital educational visit from the nurse followed by 1 home visit within 1 week of discharge from the pharmacist and nurse. The purpose of the visit was to assess patients' knowledge of their medication regimen, determine compliance with that regimen (on the basis of pill count), and assess patients' physical status. Patients who had poor knowledge of their regimen or poor compliance with the regimen received additional intervention. Information from the home visit was provided to the patient's primary physicians. After 6 months of follow-up and compared with the usual-care group, patients in the intervention group experienced 42% fewer hospitalizations and hospital days and had lower hospital costs, although the latter did not reach statistical significance.

To determine the long-term impact of the intervention described here, Stewart et al⁷⁹ extended follow-up of the original cohort⁶² for a total of 18 months. At the end of the follow-up period, patients in the intervention group experienced fewer out-of-hospital deaths and unplanned readmissions and required fewer days of hospitalization and emergency department visits than did the usual-care patients. As a result, the cost of hospital care was significantly lower for patients in the intervention group and more than compensated for the cost of the home-based intervention.

Nurse-Managed/Directed Care

Rich et al⁷⁶ conducted the first randomized controlled clinical trial of a heart failure management program based on the pharmacological and nonpharmacological management principles outlined in heart failure consensus guidelines. In this study, they pilot tested a comprehensive, multidisciplinary, nurse-directed heart failure management program. After the pilot test demonstrated the feasibility of the intervention and a trend toward fewer rehospitalizations and hospital days,⁷⁶ these investigators examined the outcomes from their intervention in a group of 282 heart failure patients (37% were men, mean age 79 years).³⁷ Patients were randomized to either usual care or the heart failure program after a hospitalization for heart failure. The multicomponent program consisted of (1) inpatient medication analysis and adjustment by a geriatric cardiologist, (2) intensive inpatient heart failure education by a cardiovascular nurse, (3) diet assessment and instruction by a registered dietician, (4) social services consultation and discharge planning, and (5) intensive follow-up by home health services and follow-up by the study nurse through home visits and telephone contact. At 90-day follow-up, patients in the intervention group demonstrated 56% fewer rehospitalizations for heart failure, 61% fewer multiple admissions, a 36% reduction in hospital days, significantly improved quality of life as measured with the Chronic Heart Failure Questionnaire,⁸¹ and lower costs compared with the usual-care group. There was a trend toward better survival rates for 90 days without readmission in the intervention group and significantly better survival in the intervention group when the analysis was confined to patients in both groups who survived the initial hospitalization.

In testing the MULTIFIT model that emphasizes the development of a cognitive, executive, and organizational infrastructure to promote optimal chronic disease management, West et al⁷³ studied 51 heart failure patients (71% were men, mean age 66 ± 10 years). Outcomes before institution of the program were compared with those after institution of the program. The program was a physician-supervised, nurse-managed home-based intervention that was based on heart failure consensus guidelines. At an initial visit, nurses educated and counseled patients on heart failure and its management and on behavioral techniques to enhance compliance. This visit was followed by weekly telephone calls for 6 weeks and continued intensive education and counseling to promote adherence to diet and drug regimens and self-monitoring of symptoms; risk factor modification; and promotion of activity. Patient care was under the control of primary physicians, but nurses contacted patients to promote optimization of drug therapy according to consensus guidelines that were adapted to local practice. A cardiologist was available for consultation on difficult cases. Doses of ACE inhibitors increased significantly after referral to the program, and dietary sodium intake decreased by 38%. Compared with the 6 months before enrollment in the program, patients experienced a 23% decrease in general medical visits, a 31% decrease in visits to cardiologists, and a 67% decrease in emergency department visits after referral. Compared with the 12 months before referral, patients exhibited an 87% reduction in heart failure rehospitalizations and a 74% reduction in total hospitalizations after referral. Functional status and quality of life improved after referral to the program.

In another example of a home-based telephone intervention, Shah et al⁷⁴ conducted a study to improve heart failure outcomes that consisted of 8 weekly educational mailings combined with weekly telephone contact from a nurse and reminders to patients via a pager to take medications, weigh themselves, and measure their heart rate and blood pressure. A total of 27 heart failure patients (100% were men, mean age 62 years) were studied after referral to this program from the San Francisco Veterans Affairs Medical Center. Patients' cardiologists were given monthly reports of assessment data and were notified immediately via fax of signs of worsening heart failure and excessive weight gain. Compared with a similar period before the intervention, outcomes after an average follow-up of 8.5 months included a 67% reduction in cardiovascular hospitalizations and 92% fewer hospital days. The greatest program benefit was seen in the patients with the most severe heart failure.

Heart failure patients were among the targets of a comprehensive discharge planning and home follow-up program for hospitalized elders that was managed by advanced practice nurses.⁷⁸ In this study, 363 elderly patients (50% were men, 60 with heart failure) with 1 of several medical or surgical diagnoses (which were among the major reasons for Medicare beneficiary hospitalization) were randomly assigned to usual care or the program. The program consisted of individualized discharge planning followed by 4 weeks of home care from an advanced practice nurse with expertise in managing elders at high risk for poor outcomes after hospital discharge. Both patients and their family/caregivers were recipients of

care that included assessment; education, counseling, and other appropriate intervention regarding medications, symptom management, diet, activity, sleep, medical follow-up, and emotional status. Patient and caregiver self-management was emphasized. Nurses were available via telephone for patient needs and collaborated with patients' physicians to make needed adjustments in therapy. Compared with the usual-care control group, patients in the intervention group were significantly less likely to have a hospital readmission and had fewer multiple admissions and hospital days. In addition, time to first hospitalization was increased in the intervention group. The intervention was significantly more efficacious for patients with heart failure than for those without heart failure.

Increased Access to Primary Care

Weinberger et al⁷⁷ studied the impact of intensive primary care on outcomes in 1396 patients (100% were men, 504 with heart failure) who were veterans who had been discharged from the General Medical Service of Veterans Affairs Medical Centers with a diagnosis of diabetes, chronic obstructive pulmonary disease, or heart failure. Using a randomized controlled clinical trial, these investigators assigned enrolled patients to either usual care or a program of increased access to primary care. The intensive primary care program included care directed by teams of primary care physicians and nurses. Care consisted of (1) assessment by a primary care nurse before patient discharge of postdischarge needs, provision of relevant educational materials, and assignment of a primary care physician with a card given to the patient that contained the names and numbers of the primary care team; (2) a visit by the primary care physician before discharge to discuss the postdischarge regimen; (3) a clinic appointment within 1 week of discharge; (4) a telephone call from the primary care nurse within 2 days of discharge to assess problems; and (5) revision of the therapeutic plan by the physician and nurse at clinic visits. Outcomes included significantly greater numbers of rehospitalizations, hospital days, and multiple admissions in heart failure patients randomized to the program of increased access to primary care compared with the usual-care group. There was no difference in quality of life between the groups, but patients in the intervention group reported greater satisfaction with care.

Conclusions and Recommendations Regarding Heart Failure Programs

With the exception of the study by Weinberger et al,⁷⁷ each of the programs reviewed here demonstrated positive patient outcomes. These positive outcomes included lower total and heart failure rehospitalization rates, fewer hospital days, improved quality of life and functional status, and lower healthcare costs despite the increased cost of the programs. Although most of the studies that we reviewed did not include survival analyses, probably because they were underpowered to detect survival differences, 2 studies did demonstrate a survival advantage for patients enrolled in heart failure programs.^{37,79}

The positive outcomes from these heart failure management programs should be considered in light of their limita-

tions. Most of these studies were not randomized controlled trials. Only 1 program among the heart failure clinics⁷⁵ and 3 among the community outreach programs^{37,62,76,78,79} were tested through random assignment of patients to either usual care or the program under study. The result of failure to use a randomized controlled design usually is inflation of the magnitude of the impact of the program on outcomes. The magnitude of inflation in this group of studies appears to be ≈ 2 -fold.

Another potential limitation of this group of studies is restricted generalizability of the findings. Although a total of 2930 patients were studied in the group of programs described, sample sizes in individual studies were relatively small, with the exception of the study by Weinberger et al.⁷⁷ In addition, women and minorities were unequally represented in most programs. Combined, <31% of the patients enrolled in this group of studies were women and <36% were of a racial or an ethnic minority or ethnicity was not described.

Despite these limitations, the consistency of findings among this group of studies increases confidence in the soundness of their results. Thus, together this group of studies demonstrate that it is possible to substantially reduce rehospitalization rates and costs and to improve functional status and quality of life in patients discharged from a hospitalization for heart failure when specialized care delivery models are used. However, there are unresolved challenges in the translation of these care delivery models into programs that are cost effective and efficacious in routine clinical practice.

A major challenge is to identify the combination of interventions within a given program that is effective. Because there have been no studies that compare the relative effectiveness of different programs or compare individual components or combinations of components within programs, there remain several unanswered questions. For example, is a truly multidisciplinary team necessary, or is it sufficient for teams of nurses and physicians to manage patients? Is an advanced practice nurse-managed clinic or home-care program more, less, or equally effective in terms of multiple outcomes compared with a physician-managed program? Future research is needed to examine which programs and components of programs are necessary to produce positive outcomes in terms of decreased hospitalizations, reduced costs, and improved quality of life.

Until such research is available, however, identification of the components common to successful programs that are adaptable to a variety of communities and settings can provide guidance to clinicians (Table 6). Optimization of medical therapy based on consensus heart failure guidelines is an important aspect of care for heart failure programs.^{30,36,41,66,82} Comprehensive and intensive patient education and counseling about heart failure and its treatment and the importance of compliance appear to be fundamental to any program.* Frequent follow-up and increased access to healthcare providers also appear to be vital components of a successful heart failure program.^{30,71-73,78,82} Equally effective

*References 30, 37, 41, 62, 71, 73, 74, 76, 78, and 79.

TABLE 6. Components of Successful Healthcare Delivery Models for Heart Failure

Physician-directed care with assistance from nurse coordinators in patient management or nurse-managed care by experienced advanced practice cardiovascular nurses with access to a cardiologist for consultation
Intensive, comprehensive patient and family/caregiver education about heart failure with an emphasis on a low-salt diet, medications, symptoms that signal worsening heart failure, weighing, and management strategies for problems
Vigilant, frequent follow-up after hospital discharge
Optimization of medical therapy (ensuring patients are prescribed the appropriate drugs in appropriate doses) with published guidelines based on large-scale randomized, controlled clinical trials
Increased access to healthcare professionals for problems by telephone or "walk-in" appointment
Early attention to signs and symptoms of fluid overload (ie, flexible diuretic regimen)
Supplementation of in-hospital education with outpatient education
Coordination with home health agencies where appropriate
Attention to behavioral strategies to increase compliance
Emphasis on addressing personal, financial, and social barriers to compliance
Assessment and assistance in management of social and financial concerns

Adaptable to communities without academic medical centers.

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forms of follow-up included clinic visits, telephone calls, and home visits.

Examination of the intervention tested by Weinberger et al⁷⁷ provides additional insight into program components that seem to be necessary to improve outcomes in heart failure. On the basis of their data, it appears that intensive primary care alone without attention to heart failure-specific education, intensive follow-up, and optimization of medical therapy will not reduce rehospitalizations or improve quality of life.⁷⁷

In making decisions about which components to include in a program, the characteristics of the target population must be examined. For example, if the heart failure population to be targeted consists of very elderly patients, a program that includes some component of home care is likely to be more successful given the mobility and transportation difficulties experienced by many elderly patients.⁸³ In addition, elderly patients are a more vulnerable population due to often unresolved social and financial issues. The inclusion of mechanisms to address these issues is important to the success of a program.⁷⁸

Another challenge in the translation of this research into practice is determining how to implement a heart failure program outside of an academic medical center. All of the interventions described above were conducted in such centers, where there is greater access to specialized heart failure professionals and other resources. Many of these heart failure programs were formed, for the most part, to conduct pharmaceutical trials or to manage patients before and after heart transplantation. The staff were thus supported either by industry funds or, in the case of transplant programs, by

hospital administrators who were anxious to establish the heart transplant profile of the institution. Although the integrated approach demonstrated in these programs has become the standard by which care for patients with advanced heart failure is judged, the majority of heart failure patients are neither candidates for pharmaceutical trials nor candidates for heart transplantation. Many community-based programs are trying to provide the intensive care these patients require, although reliable sources of reimbursement for the commitment of specialized nursing are just beginning to become available.

Implementation of a heart failure program in a community setting not associated with an academic medical center depends on guidance from committed, experienced clinicians. Cardiologists and experienced cardiovascular advanced practice nurses (ie, nurse practitioners or clinical nurse specialists) manage many successful heart failure programs in a variety of communities across the United States. Routine care and follow-up are performed based on published heart failure consensus guidelines, and protocols or clinical pathways are developed.⁸⁴⁻⁸⁶ A team that includes physicians and nurses typically sets up these programs, and the program ideally is designed with the unique needs of the heart failure population in a given community in mind. Many existing programs offer consultative services to assist others in setting up a program.

An integral part of any heart failure specialty program is evaluation, and every program should include a plan for evaluation of its effectiveness. Evaluation of the impact of a program allows for refinement to improve program effectiveness and provides data when seeking reimbursement for a program from managed care organizations and insurance companies. Schulman et al⁸⁷ described the steps for evaluation of heart failure disease management programs: (1) define the patient population (ie, define the characteristics of patients eligible for the service), (2) define the goals of the program (ie, improvement in functional status and quality of life and reduction in rehospitalizations and costs), (3) measure the effectiveness of the program, (4) analyze risk adjustment and outcomes, and (5) reevaluate the program through continuous quality improvement.

Conclusions

The incidence of heart failure is increasing. It is therefore incumbent on healthcare providers to evaluate their heart failure practices and to incorporate the most current knowledge of the pathophysiology, assessment, and treatment modalities for heart failure into their patient care. Current practice guidelines provide a basis for the treatment of patients with heart failure. Critical to the success of heart failure management is the discharge planning process and follow-up in the outpatient setting. Integration of medical care and patient education with close communication between inpatient and outpatient care providers is essential. Monitoring and enhancement of patient compliance are the responsibility of both in-hospital and outpatient heart failure team members. An integrated and innovative approach to the management of heart failure patients based on consensus recommendations can contribute to improved patient outcomes, including reduced morbidity rates, improved func-

tional status and quality of life, enhanced compliance, reduced rates of rehospitalization, reduced costs, and prolonged survival.

References

- American Heart Association. 2000 Heart and Stroke Statistical Update. Dallas, Tex: American Heart Association; 1999.
- Rich MW. Epidemiology, pathophysiology, and etiology of congestive heart failure in older adults. *J Am Geriatr Soc.* 1997;45:968-974.
- Kannel WB, Belanger AJ. Epidemiology of heart failure. *Am Heart J.* 1991;121:951-957.
- Starling RC. The heart failure pandemic: changing patterns, costs, and treatment strategies. *Cleve Clin J Med.* 1998;65:351-358.
- Kannel WB, Ho K, Thom T. Changing epidemiological features of cardiac failure. *Br Heart J.* 1994;72(suppl 2):S-3-S-9.
- Adams KF Jr, Zannad F, France N. Clinical definition and epidemiology of advanced heart failure. *Am Heart J.* 1998;135:S-204-S-215.
- O'Connell JB. The economic burden of heart failure. *Clin Cardiol.* 2000;23:III-6-III-10.
- Young JB. The cardiac response to injury. In: Mills RM, Young JB, eds. *Practical Approaches to the Treatment of Heart Failure.* Baltimore, Md: Williams & Wilkins; 1998:18-30.
- Young JB. The circulatory and physiologic responses in heart failure. In: Mills RM, Young JB, eds. *Practical Approaches to the Treatment of Heart Failure.* Baltimore, Md: Williams & Wilkins; 1998:31-40.
- Francis GS. Changing the remodeling process in heart failure: basic mechanisms and laboratory results. *Curr Opin Cardiol.* 1998;13:156-161.
- Katz AM. Evolving concepts of heart failure: cooling furnace, malfunctioning pump, enlarging muscle, part I. *J Card Fail.* 1997;3:319-334.
- Katz AM. Evolving concepts of heart failure: cooling furnace, malfunctioning pump, enlarging muscle, part II: hypertrophy and dilatation of the failing heart. *J Card Fail.* 1998;4:67-81.
- Packer M. The neurohormonal hypothesis: a theory to explain the mechanism of disease progression in heart failure. *J Am Coll Cardiol.* 1992;20:248-254.
- Pfeffer MA, Braunwald E. Ventricular remodeling after myocardial infarction: experimental observations and clinical implications. *Circulation.* 1990;81:1161-1172.
- Francis GS, McDonald KM. Left ventricular hypertrophy: an initial response to myocardial injury. *Am J Cardiol.* 1992;69:3G-9G.
- Francis GS, McDonald KM, Cohn JN. Neurohumoral activation in pre-clinical heart failure: remodeling and the potential for intervention. *Circulation.* 1993;87(suppl IV):IV-90-IV-96.
- Morgan HE, Baker KM. Cardiac hypertrophy: mechanical, neural, and endocrine dependence. *Circulation.* 1991;83:13-25.
- Heart Failure Guideline Panel. *Heart Failure: Evaluation and Care of Patients With Left Ventricular Systolic Dysfunction.* Rockville, Md: US Department of Health and Human Services, Agency for Health Care Policy and Research; 1994; Clinical Practice Guideline No. 11, AHCPR publication No. 94-0612.
- ACC/AHA Task Force on Practice Guidelines. Guidelines for the evaluation and management of heart failure. *Circulation.* 1995;92:2764-2784.
- Packer M, Cohn JN. Consensus recommendations for the management of chronic heart failure. *Am J Cardiol.* 1999;83:1A-5A.
- Prystowsky EN, Benson DW, Fuster V, et al. Management of patients with atrial fibrillation: a statement for healthcare professionals from the Subcommittee on Electrocardiography and Electrophysiology, American Heart Association. *Circulation.* 1996;93:1262-1277.
- Stevenson LW, Massie BM, Francis GS. Optimizing therapy for complex or refractory heart failure: a management algorithm. *Am Heart J.* 1998;135:S293-S309.
- Stevenson LW, Braunwald E. Recognition and management of patients with heart failure. In: Goldman L, Braunwald E, eds. *Primary Cardiology.* Philadelphia, Pa: WB Saunders; 1998:310-329.
- Stevenson LW, Perloff JK. The limited reliability of physical signs for estimating hemodynamics in chronic heart failure. *JAMA.* 1989;261:884-888.
- Economides E, Stevenson LW. The jugular veins: knowing enough to look. *Am Heart J.* 1998;136:6-9.
- Drazner MH, Hamilton MA, Fonarow G, et al. Relationship between right and left-sided filling pressures in 1000 patients with advanced heart failure. *J Heart Lung Transplant.* 1999;18:1126-1132.
- Stevenson LW, Steimle AE, Fonarow G, et al. Improvement in exercise capacity of candidates awaiting heart transplantation. *J Am Coll Cardiol.* 1995;25:163-170.
- Lucas C, Johnson W, Flavell C, et al. Freedom from congestion at one month predicts good two-year survival after hospitalization for class IV heart failure. *Circulation.* 1996;94(suppl I):I-193. Abstract.
- Skotzko C, Krichen C, Zierowski G, et al. Congestive heart failure and depression: frequency and impact of depression on functional status. *J Am Coll Cardiol.* 1999;33:210A. Abstract.
- Fonarow GC, Stevenson LW, Walden JA, et al. Impact of a comprehensive heart failure management program on hospital readmission and functional status of patients with advanced heart failure. *J Am Coll Cardiol.* 1997;30:725-732.
- Belardinelli R, Georgiou D, Cianci G, et al. Randomized, controlled trial of long-term moderate exercise training in chronic heart failure: effects on functional capacity, quality of life, and clinical outcome. *Circulation.* 1999;99:1173-1182.
- The SOLVD Investigators. Effects of enalapril on survival in patients with reduced left ventricular ejection fractions and congestive heart failure. *N Engl J Med.* 1991;325:292-302.
- Kannel WB. Epidemiological aspects of heart failure. *Cardiol Clin.* 1989;7:1-9.
- Dracup K, Moser DK, Taylor SE, et al. The psychological consequences of cardiopulmonary resuscitation training for family members of patients at risk for sudden death. *Am J Public Health.* 1997;87:1434-1439.
- Riegel B. Training nontraditional responders to use automated external defibrillators. *Am J Crit Care.* 1998;7:402-410.
- Serxner S, Miyaji M, Jeffords J. Congestive heart failure disease management: a patient education intervention. *Congestive Heart Failure.* 1998;4:23-28.
- Rich MW, Beckham V, Wittenberg C, et al. A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure. *N Engl J Med.* 1995;333:1190-1195.
- Friedman MM. Older adults' symptoms and their duration before hospitalization for heart failure. *Heart Lung.* 1997;26:169-176.
- Francis G. Approach to the patient with severe heart failure. In: Rose E, Stevenson L, eds. *Management of End-Stage Heart Disease.* Philadelphia, Pa: Lippincott-Raven; 1998:39-52.
- Bennett SJ, Huster GA, Baker SL, et al. Characterization of the precipitants of hospitalization for heart failure decompensation. *Am J Crit Care.* 1998;7:168-174.
- Smith LE, Fabbri SA, Pai R, et al. Symptomatic improvement and reduced hospitalization for patients attending a cardiomyopathy clinic. *Clin Cardiol.* 1997;20:949-954.
- Konstam M, Dracup K, Baker D, et al. *Heart Failure: Management of Patients With Left Ventricular Systolic Dysfunction: Clinical Practice Guideline for Clinicians No. 11.* Rockville, Md: Agency for Health Care Policy and Research, Public Health Service, US Department of Health and Human Services; June 1994, AHCPR Publication No. 94-0613.
- Regan TJ. Alcohol and the cardiovascular system. *JAMA.* 1990;264:377-381.
- Coats AJS, Adamopoulos S, Radaelli A, et al. Controlled trial of physical training in chronic heart failure: exercise performance, hemodynamics, ventilation, and autonomic function. *Circulation.* 1992;85:2119-2131.
- Dubach P, Myers J, Dziekan G, et al. Effect of high intensity exercise training on central hemodynamic responses to exercise in men with reduced left ventricular function. *J Am Coll Cardiol.* 1997;29:1591-1598.
- Hambrecht R, Fiehn E, Yu J, et al. Effects of endurance training on mitochondrial ultrastructure and fiber type distribution in skeletal muscle of patients with stable chronic heart failure. *J Am Coll Cardiol.* 1997;29:1067-1073.
- Keteyian SJ, Levine AB, Brawner CA, et al. Exercise training in patients with heart failure: a randomized, controlled trial. *Ann Intern Med.* 1996;124:1051-1057.
- Elkayam U, Roth A, Weber L, et al. Isometric exercise in patients with chronic advanced heart failure: hemodynamic and neurohumoral evaluation. *Circulation.* 1985;72:975-981.
- Jaarsma T, Dracup K, Walden J, et al. Sexual function in patients with advanced heart failure. *Heart Lung.* 1996;25:262-270.
- Packer M, Bristow MR, Cohn JN, et al. The effect of carvedilol on morbidity and mortality in patients with chronic heart failure: US Carvedilol Heart Failure Study Group. *N Engl J Med.* 1996;334:1349-1355.

51. Packer M, Wilson S, Colucci MD, et al. Double-blind, placebo-controlled study of the effects of carvedilol in patients with moderate to severe heart failure: the PRECIS Trial. *Circulation*. 1996;94:2793–2799.
52. Miller NH, Hill M, Kottke T, et al. The multilevel compliance challenge: recommendations for a call to action: a statement for healthcare professionals. *Circulation*. 1997;95:1085–1090.
53. Ghali JK, Kadakia S, Cooper R, et al. Precipitating factors leading to decompensation of heart failure. *Arch Intern Med*. 1988;148:2013–2016.
54. Vinson JM, Rich MW, Sperry JC, et al. Early readmission of elderly patients with congestive heart failure. *J Am Geriatr Soc*. 1990;38:1290–1295.
55. Conn VS, Taylor SG, Kelley S. Medication regimen complexity and adherence among older adults. *Image J Nurs Sch*. 1991;23:4:231–235.
56. Monane M, Bohn RL, Gurwitz JH, et al. Noncompliance with congestive heart failure therapy in the elderly. *Arch Intern Med*. 1994;154:433–437.
57. Happ MB, Naylor MD, Roe-Prior P. Factors contributing to rehospitalization of elderly patients with heart failure. *J Cardiovasc Nurs*. 1997;11:75–84.
58. Chin MH, Goldman L. Factors contributing to hospitalization of patients with congestive heart failure. *Am J Public Health*. 1997;87:643–648.
59. Ni H, Nauman D, Burgess D, et al. Factors influencing knowledge of and adherence to self-care among patients with heart failure. *Arch Intern Med*. 1999;159:1613–1619.
60. Jaarsma T, Halfens RJ, Huijter-Abu Saad H. Readmission of older heart failure patients. *Prog Cardiovasc Nurs*. 1996;11:15–20.
61. Dracup K, Baker DW, Dunbar SB, et al. Management of heart failure, II: counseling, education and lifestyle modifications. *JAMA*. 1994;272:1442–1446.
62. Stewart S, Pearson S, Horowitz JD. Effects of a home-based intervention among patients with congestive heart failure discharged from acute hospital care. *Arch Intern Med*. 1998;158:1067–1072.
63. Dunbar SB, Jacobson LH, Deaton C. Heart failure: strategies to enhance patient self-management. *AACN Clin Issues*. 1998;9:244–256.
64. Edep ME, Shah NB, Tateo IM, et al. Differences between primary care physicians and cardiologists in management of congestive heart failure: relation to practice guidelines. *J Am Coll Cardiol*. 1997;30:518–526.
65. Philbin EF. Factors determining angiotensin-converting enzyme inhibitor underutilization in heart failure in a community setting. *Clin Cardiol*. 1998;21:103–108.
66. Hanumanth S, Butler J, Chomsky D, et al. Effect of a heart failure program on hospitalization frequency and exercise tolerance. *Circulation*. 1997;96:2842–2848.
67. ACC/AHA Task Force on Practice Guidelines. Guidelines for the evaluation and management of heart failure. *Circulation*. 1997;18:736–753.
68. Clinical Quality Improvement Network Investigators. Mortality risk and patterns of practice in 4606 acute care patients with congestive heart failure: the relative importance of age, sex, and medical therapy. *Arch Intern Med*. 1996;156:1669–1673.
69. Naylor M, Broton D, Jones R, et al. Comprehensive discharge planning for the hospitalized elderly: a randomized clinical trial. *Ann Intern Med*. 1994;120:999–1006.
70. Krumholz HM, Parent EM, Tu N, et al. Readmission after hospitalization for congestive heart failure among Medicare beneficiaries. *Arch Intern Med*. 1997;157:99–104.
71. Cintron G, Bigas C, Linares E, et al. Nurse practitioner role in a chronic congestive heart failure clinic: in-hospital time, costs, and patient satisfaction. *Heart Lung*. 1983;12:237–240.
72. Kornowski R, Zeeli D, Averbuch M, et al. Intensive home-care surveillance prevents hospitalization and improves morbidity rates among elderly patients with severe congestive heart failure. *Am Heart J*. 1995;129:762–766.
73. West JA, Miller NH, Parker KM, et al. A comprehensive management system for heart failure improves clinical outcomes and reduces medical resource utilization. *Am J Cardiol*. 1997;79:58–63.
74. Shah NB, Der E, Ruggiero C, et al. Prevention of hospitalizations for heart failure with an interactive home monitoring program. *Am Heart J*. 1998;135:373–378.
75. Cline CM, Israelsson BY, Willenheimer RB, et al. Cost effective management programme for heart failure reduces hospitalisation. *Heart*. 1998;80:442–446.
76. Rich MW, Vinson JM, Sperry JC, et al. Prevention of readmission in elderly patients with congestive heart failure: results of a prospective, randomized pilot study. *J Gen Intern Med*. 1993;8:585–590.
77. Weinberger M, Oddone EZ, Henderson WG, for the Veterans Affairs Cooperative Study Group on Primary Care and Hospital Readmission. Does increased access to primary care reduce hospital readmissions? *N Engl J Med*. 1996;334:1441–1447.
78. Naylor MD, Broton D, Campbell R, et al. Comprehensive discharge planning and home follow-up of hospitalized elders: a randomized clinical trial. *JAMA*. 1999;281:613–620.
79. Stewart S, Vandenbroek AJ, Pearson S, et al. Prolonged beneficial effects of a home-based intervention on unplanned readmissions and mortality among patients with congestive heart failure. *Arch Intern Med*. 1999;159:257–261.
80. Rector TS, Kubo SH, Cohn JN. Patients self-assessment of their congestive heart failure, part 2: content, reliability and validity of a new measure, the Minnesota Living With Heart Failure Questionnaire. *Heart Failure*. 1987;3:198–209.
81. Guyatt GH, Nogradi S, Halcrow S, et al. Development and testing of a new measure of health status for clinical trials in heart failure. *J Gen Intern Med*. 1989;4:101–107.
82. Rich MW. Heart failure disease management: a critical review. *J Card Fail*. 1999;5:64–75.
83. Anderson MA, Pena RA, Helms LB. Home care utilization by congestive heart failure patients: a pilot study. *Public Health Nurs*. 1998;15:146–162.
84. Venner GH, Seelbinder JS. Team management of congestive heart failure across the continuum. *J Cardiovasc Nurs*. 1996;10:71–84.
85. Paul S. Implementing an outpatient congestive heart failure clinic: the nurse practitioner role. *Heart Lung*. 1997;26:486–491.
86. Brass-Mynderse NJ. Disease management for chronic congestive heart failure. *J Cardiovasc Nurs*. 1996;11:54–62.
87. Schulman KA, Mark DB, Califf RM. Outcomes and costs within a disease management program for advanced congestive heart failure. *Am Heart J*. 1998;135:S285–S292.

KEY WORDS: AHA Scientific Statement ■ heart failure ■ prevention