

Care Management Interventions for Older Patients With Congestive Heart Failure

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AUDIENCE

This activity is designed for physicians, care managers, and health-plan leaders.

GOAL

To identify interventions and outcome measures that should be included when designing and assessing the effectiveness of care management programs for older adults with congestive heart failure (CHF).

EDUCATIONAL OBJECTIVES

Upon successful completion of this educational program, the reader should be able to:

1. Identify CHF care management strategies and outcome measures that have been investigated in published studies.
2. Assess the potential effectiveness of the various published care management strategies for CHF in older patients.
3. Determine whether any strategy or combination of strategies seems particularly beneficial based on published reports.
4. Comment on those outcome measures that are most likely to be helpful in determining the overall clinical efficacy and cost effectiveness of care management for older patients with CHF.

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Accreditation

The University of Pennsylvania School of Medicine is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

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To receive credit for your completion of this educational activity, you should read and review the material contained in this article, correctly answer the posttest questions, and complete the evaluation and request for credit information. All requests for credit must be submitted to the University of Pennsylvania School of Medicine Office of Continuing Medical Education within the term of approval for this activity and a score of at least 80% correct achieved on the posttest in order to receive CME credit.

The estimated time to complete this activity is 1 hour.

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Objectives: To identify interventions and outcome measures that should be included when designing care management programs for older patients with congestive heart failure (CHF) and assessing the overall effectiveness of these programs.

Study Design: Structured literature review and assessment.

Methods: A systematic literature search was conducted to identify articles that described interventions and outcome measures designed to improve care for older patients with CHF. Resultant studies were classified according to design, and interventions and outcome measures were categorized. Finally, the data were analyzed to identify care management strategies and outcome measures associated with effective studies (defined as those that achieved improvement in more than half of the important outcome measures).

Results: Thirty-two studies were identified. Most of the effective programs employed both a physician and a nurse; 12 employed a case manager. Hospital utilization was typically reduced by 30% to 80% in studies that measured this factor, although utilization increased in 2 studies. Only 6 studies showed significant reductions in costs. Fifteen of the studies were categorized as effective; 15 showed trends toward improvement; and 2 studies in which intervention subjects worsened appeared to have design flaws and subject selection biases.

Conclusion: Care management interventions can be clinically effective, although cost effectiveness remains to be established. Common elements in effective care management programs included the teaming of a physician with a nurse or care manager; frequent patient monitoring for CHF decompensation; and patient education to improve self-assessment skills. Most ineffective programs showed deficiencies in nurse training, study design, or patient selection.

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Congestive heart failure (CHF) remains the most frequent cause of hospital admission for older adults in the Medicare program, despite pharmacologic advances in its treatment. Readmission rates for patients with CHF are approximately 25% at 3 months and 50% at 6 months.¹ More than half of the people hospitalized for heart failure are older than 75 years; 80% are aged 65 years and older.² In 1998, an estimated 4.7 million individuals in the United States carried the diagnosis of CHF. The economic impact is substantial: the estimated direct and indirect costs of CHF in 2002 totaled \$23.2 billion.² These numbers are expected to rise as the number of older adults increases.

Care management for patients with CHF is not a new concept, but reports on its clinical efficacy and cost effectiveness have been regularly published only recently. A report from 1969 recognized the importance of new approaches to CHF management and recommended employing public health nurses to improve patient outcome,³ and the earliest identified investigation of care management for CHF was published in 1971.⁴ The next identified intervention, however, was not published until 1983.⁵ Since then, the number of published studies on care management for patients with CHF has increased, particularly in recent years, and a recent meta-analysis of 12 studies concluded that care management programs for CHF patients appear to be cost effective.⁶

The magnitude of the problem of CHF and the belief that care management is beneficial have led the Center for Medicare and Medicaid Services (CMS), formerly known as the Health Care Finance Administration (HCFA), to undertake a new demonstration project called the Medicare Coordinated Care Demonstration (<http://www.cms.hhs.gov>). Fifteen sites have been selected where a variety of management strategies for chronic diseases, including CHF, are being investigated. These demonstration projects, implemented on a rolling basis since July 1, 2001, are intended to test the cost effectiveness of paying for coordinated care services for Medicare

beneficiaries with chronic illnesses. Although these projects are designed to broadly test the efficacy and cost effectiveness of care management, at this time there is no universal understanding of what care management is or how it should be performed.

The purpose of this review is to better define the components of successful care management for older patients with CHF. The objectives are to identify care management strategies and outcome measures that have been investigated in previous studies; assess the potential effectiveness of the various published strategies; determine whether any strategy or combination of strategies seems particularly beneficial based on published reports; and comment on outcome measures that are most likely to be helpful in establishing the overall clinical efficacy and cost effectiveness of care management for CHF.

METHODS

Using the terms and keywords congestive heart failure, elderly, disease management, nurse-led clinics, and interventions, a MEDLINE literature search was carried out to identify reports that described intervention strategies to decrease morbidity and mortality secondary to CHF. The search was limited to articles published in English between 1966 and March 2002. References cited in the selected articles were also examined to identify similar studies for subsequent inclusion. This latter method was employed until no new studies were identified.

Studies were included for detailed review if they (1) described an intervention program to improve patient outcome or reduce healthcare utilization among older patients with CHF, and (2) provided results of measurable outcomes for these patients. These liberal inclusion criteria allowed a review of the broad range and variety of interventions and outcomes that have been investigated and described, including not only randomized controlled trials, but also retrospective analyses and descriptive studies.

Thirty-six studies were initially identified, including 24 that were located through electronic literature review and 12 that were found by reviewing the reference citations for these studies. Three studies included groups of patients with multiple medical and surgical diagnoses.⁷⁻⁹ Because it was difficult to differentiate outcome measures among enrollees with and without CHF in these studies, they were eliminated from the review. A study that primarily involved younger adults with CHF (mean age 54) was also eliminated.¹⁰

The remaining 32 studies were carefully read to identify unique interventions and outcomes related to providing care for patients with CHF. These data were then organized into tables to facilitate analysis of study size and design, services and interventions that were included, utilization outcomes and patient-specific outcomes, and trends in important outcome measures, defined as those measures for which statistical significance was reported in at least 3 studies.

Care management programs were classified as effective or ineffective based on statistical changes in the important outcome measures. Effective interventions were defined as those in which improvements occurred in more than half of these measures. Ineffective programs included those in which improvements did not reach statistical significance as well as those few studies in which statistically significant negative outcomes occurred within the treatment group.

RESULTS

Overview

Although studies from as early as 1971 were identified,⁴ 24 of the 32 studies reviewed here (75%) have been published since 1998. Fifteen of the studies were randomized controlled trials, 16 were retrospective-prospective comparison studies, and 1 was a descriptive study. For the 31 studies in which the number of intervention subjects was reported, the median number of subjects was 63 (range, 15-1915).

Interventions

Table 1 summarizes basic study parameters by year, including design, sample size for control and intervention groups, and services involved. Most provider designations were obvious (eg, primary care physician or cardiologist); however, the term care manager was assigned to describe individuals of many titles who assisted in arranging multiple aspects of care for a patient (whether or not they provided medical interventions) and who coordinated this care by communicating with the patient's physician or providers in other disciplines.

Although most of the interventions could be easily categorized, there was important variability in the interventions included within each category, which is described.

Physician Services. Not unexpectedly, 24 of 32 studies (75%) included cardiologists. Ten of these

relied on cardiologists without mention of primary care providers. In 20 of the 32 studies (63%), primary care physicians were explicitly noted or described as involved in the intervention project. Of these 20 studies, 5 explicitly studied primary care physicians and nurses working together without the expertise of a cardiologist^{8,12,14,20,23}; 1 described programs in which nurses performed patient follow-up and reported findings to a community physician, usually a primary care physician²⁶; and the remaining 14 studies utilized either cardiologists alone or cardiologists working with primary care physicians.

Involvement of the primary care doctor was variable, and studies often gave vague descriptions of the relationship between the cardiologist and the patient's primary care physician. For example, Fonarow et al assessed an outpatient cardiology clinic that "worked in conjunction with the patient's primary care physician" as part of a comprehensive management program.¹⁵ Rich and colleagues published 2 studies involving a geriatric cardiologist who supervised the study nurse and reviewed medications of inpatients in the intervention group.^{11,13} Before hospital discharge, the geriatric cardiologist "made recommendations to the patient's physician" regarding medication adjustments. Ekman et al described a more involved approach wherein the "primary care provider and the home health staff were continually informed" and on several occasions assisted each other, for example, by obtaining blood samples needed for monitoring purposes during a patient visit.²⁰

Nursing Services. Nurses were involved in 31 of the studies (97%). In most cases, nurses were an integral part of the care management strategy. Their duties included, in various combinations and degrees of intensity, performing inpatient, outpatient, and in-home evaluations; educating patients; making treatment or patient support service recommendations to physicians (eg, physical therapy, counseling); and coordinating care telephonically or electronically. Paralleling the recent increase in the number of midlevel practitioners in the United States (eg, nurse practitioners and physician assistants), 9 studies (28%) described interventions in which midlevel practitioners provided supplemental care.^{5,15,17,28,31-33,35,37} The earliest study that included a midlevel practitioner, published in 1983, described a nurse practitioner-led CHF clinic⁵; but nurse practitioner involvement was not reported again until 1997.^{15,17} The most common theme, regardless of nurse training, was reliance on nursing expertise to provide patient education and frequent

CONTINUING MEDICAL EDUCATION

Table 1. Chronologic Overview of Design, Sample Size, and Services in Published Reports of Care Management Programs for Patients With CHF

Publication Year	First Author	Study Design	Size of Control Group	Size of Intervention Group	Physician Services			Nonphysician Services					Other Services					
					Primary Care	Geriatric Cardiologist	Geriatric Nurse	Care Manager	Pharmacist	Social Worker	Dietitian	Physical Therapist	Home Visits	Written/Video Materials	Telephone Follow-up	Electronic Monitoring		
1971	Rosenberg ⁴	RPC	50	50		X		X	X		X	X		X				
1983	Cintron ⁵	RPC	NA	15		X		X										
1993	Rich ¹¹	RCT	35	63	X			X		X	X		X	X		X		
1995	Kornowski ¹²	RPC	NA	42	X			X					X	X				
1995	Rich ¹³	RCT	140	142	X			X		X	X		X	X		X		
1996	Weinberger ¹⁴	RCT	255	249	X			X									X	
1997	Fonarow ¹⁵	RPC	NA	214	X	X		X	X					X		X		
1997	Hanumanthu ¹⁶	RPC	NA	134		X		X	X				X					
1997	Smith ¹⁷	RPC	NA	20		X		X										
1997	West ¹⁸	RPC	NA	51	X	X		X	X								X	
1998	Cline ¹⁹	RCT	79	56	X	X		X						X				
1998	Ekman ²⁰	RCT	79	79	X			X	X					X		X		
1998	Serxner ²¹	RCT	54	55				X						X				
1998	Shah ²²	RPC	NA	27		X		X						X		X	X	
1998	Stewart ⁸	RCT	48	49	X			X		X				X	X			
1998	Tilney ²³	RPC	NA	1915	X			X	X	X				X	X		X	
1999	Cordisco ²⁴	DS	51	30		X		X									X	
1999	Gattis ²⁵	RCT	91	90		X			X									
1999	Heidenreich ²⁶	RPC	86	43	X	X		X						X		X	X	
1999	Jaarsma ²⁷	RCT	95	84				X						X	X	X		
1999	Knox ²⁸	RPC	NA	?	X	X		X	X	X		X	X	X		X		
1999	Stewart ²⁹	RCT	100	100	X	X		X						X		X		
1999	Wilson ³⁰	RPC	NA	35		X		X						X				
2000	Dahl ³¹	RPC	NA	609	X	X		X	X	X	X	X				X		
2000	Paul ³²	RPC	NA	15		X		X	X	X	X			X		X		
2001	Costantini ³³	RPC	173															
		NRCT	126	283 [†]	X	X		X	X		X	X	X	X				
2001	Jerant ³⁴	RCT	12 [‡]	13	X	X		X						X		X	X	
2001	Whellan ³⁵	RPC	NA	117	X	X		X		X				X		X		
2002	Doughty ³⁶	RCT	97	100	X	X		X						X				
2002	Kasper ³⁷	RCT	98	102	X	X		X	X					X	X	X		
2002	Krumholz ³⁸	RCT	44	44				X			X			X	X	X		
2002	Riegel ³⁹	RCT	228	130	X	X		X	X		X	X	X	X		X		
Total studies using each intervention						20	22	2	31	12	7	8	8	7	14	17	18	5

*Number of patients enrolled was not reported; study encompassed 2 institutions with a total of 800 CHF admissions/year.

†An initial study involved retrospective review of data from 173 CHF patients and prospective comparison with 283 CHF patients enrolled in care management. A second study compared this latter patient sample with 126 other CHF patients enrolled in traditional care who were followed prospectively.

‡The 3 subject groups included 12 controls, 12 subjects undergoing video monitoring, and 13 subjects receiving telephone follow-up.

CHF indicates congestive heart failure; RCT, randomized controlled trial; NRCT, nonrandomized controlled trial; RPC, retrospective-prospective comparison; DS, descriptive study; NA, not applicable.

follow-ups and to relay clinically relevant findings to the patient's physician, thereby effecting more intensive management of the disease.

Care Manager Services. Care managers were employed in 12 studies. The descriptions of their

responsibilities were as diverse as their 10 different titles. The earliest identified heart failure program used a multidisciplinary team approach with a social worker as the coordinator.⁴ The social worker also provided social casework services to individual patients.

Details of the care managers' duties were sometimes lacking. One study, for example, described an intervention in a heart failure clinic in which 2 nurse coordinators worked with 3 cardiologists who had expertise in heart failure; the nurse coordinators "assisted with management of patients both during hospitalizations and as outpatients," but their duties were not delineated.¹⁶ In general, care managers assessed patients in the hospital, outpatient clinic, or both; educated or oversaw the education process for the patient, the caregivers, or both; gathered and reported information, such as medication regimens, symptoms, vital signs, and physical findings, to physicians; and, based on their assessments, made recommendations to physicians for ancillary patient needs, such as physical or occupational therapy or social work consultations. In some cases, registered nurses or nurse practitioners who were care managers also oversaw the medical management of patients, either independently or by use of established protocols.^{18,23,37}

Nine of the 12 studies with care managers (75%) included the primary care physician in the coordination of care, either by reporting information to and accepting care recommendations from the physician, or by reporting assessments and changes in the care plan as reviewed with other physicians on the team.* In studies that did not mention the patient's primary care doctor, care managers worked with cardiologists who may or may not have been CHF specialists.

Pharmacists. In 7 studies, pharmacists were involved as participants in multidisciplinary team meetings,^{23,28,31} outpatient consultants to physicians,^{25,35} patient educators,^{8,25,32,35} or in some combination of these roles.

Social Workers. Social workers were involved in 8 studies. They were part of the standard intervention in 3 studies^{4,11,13} and were consulted as deemed necessary in the remaining studies.

Dietitians. Eight studies employed dietitians for the education of patients and their families. In 3 studies, dietitians were involved with all hospitalized patients in the intervention group.^{4,11,13} In 2 studies, a dietitian was involved with patients as recommended by an inpatient care coordinator.^{31,39} The other studies employed a dietitian on an as-needed basis,^{32,33} as a member of a multidisciplinary team,²⁸ or as a developer of educational materials.²³

Physical Therapists. Only 7 studies specifically mentioned physical therapists or exercise counselors. These individuals were employed in the outpatient setting or during home visits if an evaluation identified the need, but in no studies were they part of routine care.

Home Visits. Home visits were used in 14 studies (44%). In some cases, home visits were provided at scheduled times according to study design, while in other cases they were provided on an as-needed basis. Most home visits either followed hospital discharge^{8,11,13,27,28,29} or provided routine education, management, and monitoring for outpatients.^{4,12,16,23,34,37} In 1 study, the home visit was provided only for education and support.³⁸ In some cases, home visits were provided only for patients who were unable to travel to the clinic or study site^{16,37,38}; in 1 study this involved 10% of patients,¹⁶ and in another, 45%.³⁸

Patient Education. Seventeen studies described educating patients about their disease and self-management skills. Educational programs included in-person teaching, written handouts, and videotaped presentations. The investigators often prepared the educational materials described in their studies. Two programs used group education, typically with 4 to 6 patients participating at a time.^{4,36}

Telephonic Monitoring. Nurses and care managers telephoned patients in 18 of the studies (56%). The goal of this intervention was to allow close monitoring of symptoms and reduce the need for home visits or clinic evaluations. Callers asked the patients about their symptoms and any change in weight, provided encouragement and support, and offered patients the opportunity to ask questions.

Electronic Monitoring. Five studies utilized electronic monitoring. The types of monitoring varied substantially. The simplest method involved automated paging reminders that prompted patients to measure their weight and vital signs at home, supplemented with printed educational materials and telephone calls.²² Another study used more complicated technology involving an automated online system developed and licensed by a cardiac disease management company,²³ but the details of this program were poorly described. Home-monitoring equipment for weight, vital signs, and symptoms was used in 3 studies to facilitate nurse review and physician intervention.^{24,26,34} One of these employed real-time video conferencing that incorporated a microphone, camera, and integrated electronic stethoscope, making it possible to examine the patient and converse with the patient or caregiver.³⁴

*References 15, 18, 20, 23, 28, 31, 33, 37, 39.

CONTINUING MEDICAL EDUCATION

Table 2. Chronologic Overview of Utilization Outcomes

Publication Year	First Author	Total Hospital Admissions	Time to First Readmission	Total Hospital Days	Total CHF Admissions	Cardiovascular Admissions	Cardiovascular Hospital Days	Length of Stay	Costs	Emergency Use	Outpatient Visits
1971	Rosenberg ⁴			X	X						
1983	Cintron ⁵	X		X					X		
1993	Rich ¹¹	X	X	X					X		
1995	Kornowski ¹²	X		X		X		X			
1995	Rich ¹³	X			X				X		
1996	Weinberger ¹⁴	X	X	X						X	X
1997	Fonarow ¹⁵	X							X		
1997	Hanumanthu ¹⁶	X	X		X	X					
1997	Smith ¹⁷	X			X					X	X
1997	West ¹⁸	X			X					X	X
1998	Cline ¹⁹	X	X	X					X		X
1998	Ekman ²⁰	X		X	X						
1998	Serxner ²¹				X					X	X
1998	Shah ²²	X		X		X	X				
1998	Stewart ⁸	X	X	X					X	X	
1998	Tilney ²³	X		X					X	X	X
1999	Cordisco ²⁴	X	X							X	
1999	Gattis ²⁵				X					X	
1999	Heidenreich ²⁶	X		X					X		
1999	Jaarsma ²⁷	X		X		X	X			X	
1999	Knox ²⁸	X						X	X		
1999	Stewart ²⁹	X		X					X		
1999	Wilson ³⁰	X							X		
2000	Dahl ³¹	X		X	X	X		X			
2000	Paul ³²	X		X				X		X	
2001	Costantini ³³	X						X	X		
2001	Jerant ³⁴	X		X	X			X	X	X	
2001	Whellan ³⁵	X							X		X
2002	Doughty ³⁶	X	X		X		X				
2002	Kasper ³⁷	X			X				X		
2002	Krumholz ³⁸	X	X		X	X			X		
2002	Riegel ³⁹	X	X	X	X		X		X	X	X
Total studies measuring factor		29	9	17	14	6	4	6	17	12	8

Outcomes

Most reports measured a variety of outcomes. **Table 2** shows utilization outcome measurements from each study, while **Table 3** shows other patient-specific outcomes. These tables illustrate the broad variability in outcome measures studied.

Most variables fell clearly within the listed sub-categories; given the large number of variables, however, some outcomes were grouped together:

- *cardiovascular admissions* included both cardiovascular and heart failure admissions, since

these were sometimes described separately and at other times collectively

- costs included total costs, claims, and charges for medical care
- *subjective function* included outcomes that were measured using the New York Heart Association Classification (NYHAC), the Duke Activity Status Index, both systems, or global functional status based on a scale of the patient's ability to perform daily activities
- *mortality* included any measures of death or survival rates during the study period

Hospital Utilization. Outcomes related to hospitalization were measured in all studies, although there was variability in how hospital utilization was quantified. Twenty-eight studies specifically assessed statistical significance; 16 of these (57%) showed reductions in total hospital admissions.* Eighteen of the studies reported statistical significance for cardiovascular admissions; 12 of these (67%) found significant reductions, in most cases 30% to 80%, although 1 study found significant reductions of only 7% in total admissions and 6% in cardiovascular admissions.³¹ In 9 other studies, admissions decreased in the intervention group but the reduction was not statistically significant,[†] although 2 of these studies found significant reductions in the total number of hospital days^{22,26} and 1 found a significantly reduced number of cardiovascular readmissions.³⁸ Of these 3 studies, 2 demonstrated significantly reduced costs as well.^{26,38} Finally, 2 studies reported statistically significant increased admissions among intervention subjects.^{14,30}

Other measures of hospital utilization included (1) the time from incident hospital admission until first readmission; (2) length of stay; and (3) total hospital days. The time from incident to first readmission was improved in only 3 of the 9 studies that reported it. Length of stay decreased in 3 of the 6 studies that reported this finding. Overall total number of hospital days decreased by 40% to 92% in 10 of 17 studies ($P < .05$); decreased by 11% to 49% in 6 of 17 studies ($P \geq .05$)^{11,19,20,27,34,39}; and increased in 1 study ($P < .05$).¹⁴

Emergency Department Utilization. Emergency visits were assessed in 12 studies. Five found decreased utilization^{8,17,18,24,34} and 4 showed no significant change.^{14,27,32,39} Reduction in utilization varied from 19% to 100%.^{17,24}

Outpatient Visits. Utilization of physician office visits was measured in 6 studies. Outpatient visits

were reduced by 23% (general medical clinics) and 31% (cardiology clinics) in 1 study¹⁸; in 2 studies visits were unchanged^{20,39}; and in 3 studies, outpatient visits increased.^{14,17,35}

Physiologic Measurements. Physiologic measurements were included in 10 studies. Of 9 studies reporting statistical significance, 6 used only subjective functional assessments, 1 used only objective measures, and 3 used both (Table 3). There were no standard subjective or objective measures used by all investigators. Three different questionnaires were used, and objective measures included exercise testing, imaging, and invasive monitoring. Seven of the 9 studies showed significant improvements, and 2 found no significant difference. Three studies that used both subjective and objective measurements showed significant improvements by both measurements.

Quality of Life. Quality-of-life scores improved significantly in 5 studies,^{13,16,17,36,37} but remained unchanged in 6.^{14,18,19,26,29,34} No studies showed a decline in quality-of-life scores.

Medication Use. Medication use was assessed in 12 studies. Eight showed that significant changes were made in medication regimens following implementation of the intervention, including increased prevalence of angiotensin-converting enzyme (ACE) inhibitor^{19,25,31,33} use or vasodilator use in ACE inhibitor-intolerant patients²⁵; increased mean drug dosing of ACE inhibitors^{17,18,37}; increased mean drug dosing of vasodilators when ACE inhibitors could not be used¹⁸; increased mean drug dosing of furosemide¹⁷; and increased mean drug dosing of β -blockers.³⁵ Two studies failed to show significant changes in the prevalence of use or mean drug dosing of ACE inhibitors, diuretics, or digoxin.^{16,36} Only 1 study reported changes in the cost of pharmaceutical treatment. Tilney et al reported a 60% increase in pharmaceutical costs, but other savings outweighed this increase.²³

Mortality. Mortality was measured in 13 studies. Only 1 study found a significant reduction in the number of deaths.³¹

Overall Costs. Costs were assessed in 17 studies. Six showed significant decreases,^{11,13,26,33,35,38} 6 found no difference,^{8,19,29,34,37,39} and the remaining 5 did not report statistical significance of comparisons.^{5,15,23,28,30} No studies found significantly increased costs with implementation of an intervention.

Program Effectiveness

Table 4 shows general trends in important outcome measures, which were defined as those meas-

*References 6, 8, 12, 13, 16, 18, 21, 24, 29, 31, 32, 35, 36, 39.

†References 11, 19, 20, 22, 26, 27, 34, 37, 38.

Table 3. Chronologic Overview of Physiologic and Other Patient-Specific Outcomes

Publication Year	First Author	Subjective Function	Ejection Fraction	Left Ventricle Dimensions	Exercise Time or Capacity	Peak O ₂ Consumption	Invasive Hemodynamic Assessment	Medication Adherence	Reduced Sodium Intake	Improved Self-Care	Patient Satisfaction	Quality of Life	Appropriateness of Medications	Mortality
1971	Rosenberg ⁴	X							X					
1983	Cintron ⁵										X			
1993	Rich ¹¹													
1995	Kornowski ¹²	X												
1995	Rich ¹³											X		X
1996	Weinberger ¹⁴										X	X		
1997	Fonarow ¹⁵	X				X	X						X	
1997	Hanumanthu ¹⁶				X	X						X	X	
1997	Smith ¹⁷	X	X	X	X	X						X	X	
1997	West ¹⁸	X			X				X			X	X	
1998	Cline ¹⁹											X	X	X
1998	Ekman ²⁰	X												X
1998	Serxner ²¹							X		X				
1998	Shah ²²													
1998	Stewart ⁸													X
1998	Tilney ²³	X							X		X			
1999	Cordisco ²⁴													X
1999	Gattis ²⁵												X	X
1999	Heidenreich ²⁶											X		
1999	Jaarsma ²⁷									X				
1999	Knox ²⁸							X			X		X	
1999	Stewart ²⁹											X		X
1999	Wilson ³⁰													
2000	Dahl ³¹												X	X
2000	Paul ³²													
2001	Costantini ³³							X					X	X
2001	Jerant ³⁴	X									X	X		X
2001	Whellan ³⁵							X					X	
2002	Doughty ³⁶							X				X	X	X
2002	Kasper ³⁷	X						X	X			X	X	X
2002	Krumholz ³⁸													X
2002	Riegel ³⁹										X			
Total studies measuring factor		10	1	1	3	3	1	6	4	2	6	11	12	13

ures for which statistical significance was reported in at least 3 studies. (This definition eliminated dietary assessment, as statistical significance was reported in only 2 studies.) Fifteen of the studies (47%) were categorized as effective (as shown by bolded author name). In 15 of the remaining 17 studies, most or all of the important outcome meas-

ures did not reach statistical significance. In 2 studies, most of the important outcome measures showed deterioration among patients in the treatment group, but this appeared to be related to study design, eg, lack of structured primary care follow-up¹⁴ or severity of the subject patients' disease,³⁰ and not indicative of a deleterious intervention strategy.

Table 4. Chronologic Overview of Trends in Important Outcomes

Publication Year	First Author	Total Admissions	Time to Readmission	Hospital Days	Length of Stay	Cardiac Admissions	Emergency Visits	Outpatient Visits	Costs	Function	Exercise Capability or Peak O ₂	Mortality	Quality of Life	Medication Usage
1971	Rosenberg ⁴			↓		↓				↑				
1983	Cintron ⁵	↓		↓										
1993	Rich ¹¹	NS	NS	NS		NS			↓					
1995	Kornowski ¹²	↓		↓	↓	↓				↑				
1995	Rich ¹³	↓				↓			↓			NS	↑	
1996	Weinberger ¹⁴	↑	NS	↑			NS	↑					NS	
1997	Fonarow ¹⁵	↓								↑	↑			
1997	Hanumanthu ¹⁶	↓	↑			↓					↑		↑	NS
1997	Smith ¹⁷	↓				↓	↓	↑		↑	↑		↑	↑
1997	West ¹⁸	↓				↓	↓	↓		↑	↑		NS*	↑
1998	Cline ¹⁹	NS	↑	NS				NS	NS			NS	NS	↑
1998	Ekman ²⁰	NS		NS		NS				NS		NS		
1998	Serxner ²¹	↓				↓								
1998	Shah ²²	NS		↓		NS								
1998	Stewart ⁸	↓	NS	↓			↓		NS			NS		
1998	Tilney ²³													
1999	Cordisco ²⁴	↓	NS				↓					NS		
1999	Gattis ²⁵					↓						NS		↑
1999	Heidenreich ²⁶	NS		↓					↓				NS	
1999	Jaarsma ²⁷	NS		NS		NS	NS							
1999	Knox ²⁸													
1999	Stewart ²⁹	↓		↓					NS			NS	NS	
1999	Wilson ³⁰	↑												
2000	Dahl ³¹	↓		↓	↓	↓						↓		↑
2000	Paul ³²	↓		↓	NS		NS							
2001	Costantini ³³	NS			↓				↓			NS		↑
2001	Jerant ³⁴	NS		NS	NS	NS	↓ [†]		NS	NS			NS	
2001	Whellan ³⁵	↓						↑	↓ [‡]					↑
2002	Doughty ³⁶	↓	NS	↓ [§]		↓						NS	↑	NS
2002	Kasper ³⁷	NS			NS	NS			NS	↑		NS	↑	↑
2002	Krumholz ³⁸	NS	↑			↓			↓ [‡]			NS		
2002	Riegel ³⁹	↓	NS	NS		↓	NS	NS	NS					

*Short form 36 component ($P = .27$), physical component ($P = .04$).

[†]CHF-related emergency department (ED) visits ($P = .03$); all causes of ED visits ($P = .20$).

[‡]Did not include cost of intervention.

[§]Cardiovascular-related hospital days ($P = .001$).

NS indicates nonsignificant difference ($P \geq .05$); ↑, statistically significant increases; ↓, statistically significant decreases. In studies judged effective, the author's name is bold.

DISCUSSION

This project identified 32 studies related to care management strategies for older patients with CHF. Most were published in the last few years, which is

consistent with increasing interest in and study of this topic. Review of these studies revealed the wide variety of interventions and outcome measures available and the complexity involved when such programs are designed and evaluated. Therefore, only a

small fraction of the possible interventions and outcome measures are evaluated in individual published studies, and it remains difficult to determine which interventions are the most powerful and which outcome measures are the most important. However, a careful review of the identified trials highlights some common characteristics among effective care management programs, as well as characteristics common to programs that were not effective. These are discussed below.

Characteristics of Effective Programs

Although the 15 effective studies used a variety of interventions, close monitoring of patients for symptoms or signs of CHF by nurses or care managers was a common theme. Monitoring was provided through both outpatient visits and home visits, often supplemented with telephone calls. Only 5 studies used electronic monitoring, including measurement of weight and vital signs, with reporting via telephone or Internet. It is encouraging that 3 of these were effective programs. Thus, there is a basis for optimism that electronic monitoring will be a useful strategy in the future.

Education also appears to be a critical component of effective programs. The efficacy of education appears to be greatest when it is combined with regular contact with a physician, nurse, or care manager and when it focuses on teaching the patient to recognize early warning signs of disease decompensation, thus facilitating timely treatment. Specially trained personnel often used standardized protocols to manage CHF in patients who report these warning signs. This strategy seemed most crucial when the study involved older patients with complex medical and social needs.

These observations are consonant with the meta-analysis by McAlister and colleagues,⁶ who concluded that disease management programs involving specialized follow-up by multidisciplinary teams reduce hospitalization and appear to be cost effective among patients with CHF. The term "multidisciplinary" was not defined by McAlister et al, but our review does not suggest that large teams are necessary for successful programs. Some effective programs had teams comprising only 2 individuals, a physician and a nurse.

Characteristics of Ineffective Programs

In 17 of the 32 projects, the results were judged ineffective in that they did not show significant improvement in measured outcomes. Factors that may have played a role in this include the small size

of the study, lack of structured patient monitoring, the acuity of heart failure at enrollment (including those who were either too ill or too well to benefit), and variability in the training of nurses who performed the interventions.

The importance of appropriate sample size calculations was shown by consideration of the sample sizes reported in 2 different studies by Rich et al. A 1993 pilot project involving 98 patients reported a statistically insignificant reduction in readmissions (27%).¹¹ A 1995 study involving 282 patients found a significant reduction in the number of CHF readmissions (56%), decreased costs of \$460 per patient, and improved quality-of-life scores.¹³ Neither of these studies described sample size calculations or anticipated differences in outcome between the groups, but by our calculations, with power of 0.80 and $\alpha = 0.05$, the original study would have needed 236 patients per group to detect a 27% reduction in readmission rate. Similarly, the study by Cline et al, which enrolled 79 patients in the control group and 56 in the intervention group, identified only a trend toward reduced hospital days, despite a 49% reduction in hospital days in the intervention group.¹⁹ By our calculations, 131 patients were needed in each group to detect the 49% reduction in hospital days (with power of 0.80 and $\alpha = 0.05$). In contrast, a large study found significant decreases of 7% in hospital admissions with a sample size of 609.³¹

The ineffectiveness of self management alone (ie, relying on patients to identify their own symptoms) was illustrated in 2 studies.^{19,27} In one, patients were taught how to identify symptoms of CHF and given easy access to a nurse-directed clinic, but no significant changes regarding total admissions, hospital days, or CHF readmissions were identified.¹⁹ The other study evaluated an intervention that was based entirely on a 10-day intensive education program provided by the study nurse.²⁷ Although self-care behavior increased significantly as measured by a questionnaire, healthcare utilization was not reduced. This suggests that although patient self-management should play an important role in any care management strategy, the study design must ensure concomitant outpatient supervision and reinforcement of education to achieve success.

The importance of patient selection in study design is exemplified by 4 studies. In one of them, elderly patients with moderate-to-severe heart failure were contacted by telephone 1 week after discharge and offered routine follow-up in the nurse-directed clinic.²⁰ Twenty-nine percent of these patients did not subsequently visit the clinic, either

because of institutionalization (4%) or fatigue/unwillingness (48%), or because the patient had died. Patients in the intervention group who did not regularly visit the clinic were telephoned monthly, but an intention-to-treat analysis noted no differences in outcome. The authors concluded that home-based programs might be more appropriate than clinic visits for a population of older patients with moderate-to-severe CHF.

A second study found that hospital admissions increased following referral to home health nursing as compared to the period 3 months before the referrals were made.³⁰ More than a quarter of the patients received home intravenous inotropic therapy; more than a third of all enrollees died before the 3-month follow-up interval ended; and half of all died while still enrolled in home healthcare after the follow-up ended. These authors also concluded that their subjects were too ill to benefit from the intervention program.

A third study investigated home monitoring involving an electronic system that sent notifications to the physician; subsequently, changes were made in the medical regimen.²² Three-quarters of these notifications involved patients with New York Heart Association class III or IV CHF. While most (15 of 17) patients with class III or class IV CHF rated the program very useful, only 4 of 10 patients with less severe CHF rated the program very useful, and 4 class II patients requested a reduction in telephone calls. These authors recognized that they had enrolled some patients who were too well to benefit from the intervention strategy.

The fourth study found an increase in costs and healthcare resource use in the subgroup of patients with less severe CHF, and concluded that increased access to services led to increased healthcare costs.³⁹ Thus, patients can be too ill or too well to benefit from care management, reinforcing the need for appropriate screening to identify those who will most likely benefit from an intervention.

Finally, the importance of having a structured and standardized intervention is demonstrated by 3 studies. One study used a number of home health agencies, with nurses who had varying degrees of cardiovascular experience.³⁰ These authors concluded that the lack of special training among the home care nurses may have led to the lack of improved outcomes. Another study evaluated increased access to primary care practitioners, but the practitioners did not have special cardiovascular training, nor did they use standardized CHF treatment protocols.¹⁴ The resultant lack of improvement in outcome

measures is consistent with our conclusion that standardized protocols are important. The third study taught a standardized education program and guidelines regarding patient management of diuretics based on signs and symptoms of CHF, but the clinic follow-up visits were less structured. Only 1 prescheduled visit was arranged within 8 months after hospital discharge.¹⁹ This study highlights the importance of regularly scheduled visits.

Recommendations for Interventions

Our analysis of the characteristics and intervention strategies associated with effective and ineffective programs suggests that care management programs should always include a physician and nurse team who understand the special needs of patients with CHF, including both medical and nonmedical issues. Whether the physician is a primary care practitioner or a cardiologist may not be important, but using a structured approach reliant on published, evidence-based clinical management appears to be an important component to ensure success. In this regard, it is critical to preserve some flexibility in program design to accommodate emerging treatment standards, eg, use of β -blockers for CHF patients. The team must identify each individual's need for additional services and facilitate consultations with dietitians, social workers, physical therapists, and home care service coordinators as appropriate. Education of patients, supplemented by regularly-scheduled follow-up, including home visits for the frailest subset of patients, should be included in all studies. Finally, as technology is better integrated into medicine, home or outpatient monitoring systems should be used whenever practical.

Recommendations for Outcome Measures

The variety and lack of standardization among outcome measures across the 32 studies complicates the task of recommending specific outcome measures that should be included in care management programs. Based on a critical consideration of the published literature, the following measures seem most important:

Hospital utilization should always be measured, if only because a large portion of cost associated with CHF treatment is related to inpatient services—therefore, cost effectiveness can often be indirectly established if hospitalization decreases. In this regard, the total number of admissions and total number of hospital days should always be reported. Differentiating between cardiac and noncardiac

admissions is a reasonable and simple categorization to make as well.

It is also important to quantitate emergency department visits and outpatient office visits. In successful programs, emergency department visits are reduced, potentially reducing the hospital admissions that often result when patients are seen by practitioners unfamiliar with their medical history. Note, however, that the frequency of outpatient visits may increase as part of structured care programs. Similarly, drug costs, which often represent up to 20% of total healthcare costs, may increase in effective programs. Efforts to define these costs are appropriate.

Measurement of costs is critical, although capturing total costs is often problematic because of the fragmented nature of the healthcare system in the United States. Efforts in this regard are necessary, however, if wider acceptance of these strategies is to take hold; and overall cost effectiveness certainly must be proven before routine third party reimbursement is realized.

Finally, death is a definitive outcome measure that must always be included. Keeping in mind that the mortality rate is high among older CHF patients, large studies should be capable of proving clinical effectiveness with mortality as an end point, while concomitantly demonstrating to the public that for-profit care management companies are not allowing mortality rates to increase in order to reduce healthcare costs.

The measurement of function, exercise capacity, and quality of life is more challenging, and may not be necessary if clear improvement is established using the outcome measures previously described. Similarly, changes in medication use patterns may provide indirect evidence that outcomes, such as death rates, could be expected to improve; but measurement of harder end points is encouraged.

Surprisingly, patient satisfaction and physician satisfaction were assessed in only 1 study,²² and only 2 studies assessed patient satisfaction alone.^{34,39} We recommend assessing patient and physician satisfaction in all care management programs. The importance of ensuring that physicians, in particular, are interested in program success was highlighted in 2 studies in which no physicians participated in the initial program design.^{2,33} In both cases, the initial general lack of physician interest in the program was reversed when physicians were recruited to be part of the program leadership. In one study, a special physician "team leader" was effectively used to encourage participation.²⁸

CONCLUSION

Although many care management programs for older patients with CHF have been described, there are still no widely accepted intervention strategies or outcome measures. We have identified and recommended specific intervention strategies and outcome measures that should always form the foundation of care management programs, and have suggested other strategies that are less well established, but potentially beneficial and worthy of consideration.

Fiscal considerations will always play a role in the comprehensiveness of care management programs; eg, in health plans with capitated members, there may be more willingness to invest resources when net reductions in cost appear possible, as compared to a community hospital, in which a comprehensive care management program might result in fewer admissions and decreased revenues.

Standardization in the development, implementation, and analysis of future intervention programs will allow best practice patterns to emerge that should maximize healthcare outcomes, increase patient and physician satisfaction, reduce total healthcare costs, and ultimately, represent a real improvement in the healthcare system.

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CONTINUING MEDICAL EDUCATION QUIZ

CME Self-Test

The estimated time to complete this activity is 1 hour.

Please select the best answer, entering your choices in the answer key on the next page.

1. **TRUE OR FALSE.** Most patients hospitalized for congestive heart failure (CHF) are aged 65 years or older.
 - a) True
 - b) False
2. **CHOOSE ONE.** CHF care management programs:
 - a) Are standardized and clearly defined in the literature.
 - b) Almost always include a physician and a nurse with various other additional services offered.
 - c) Universally offer home visits for homebound older adults.
 - d) Usually do not require patient or caregiver education.
3. **TRUE OR FALSE.** CHF care management programs generally result in reduced hospital admissions.
 - a) True
 - b) False
4. **TRUE OR FALSE.** Most published trials of CHF care management programs result in reduced mortality rates for older patients.
 - a) True
 - b) False
5. **CHOOSE ONE.** Effective CHF care management programs, as described in this article, included which of the following components?
 - a) Close monitoring of patients for symptoms or signs of CHF.
 - b) Education of patients and/or caregivers.
 - c) Assignment of specially trained nurses or care managers to assist with educational programs, follow-up, and monitoring of patients.
 - d) All of the above.
6. **CHOOSE ONE.** Ineffective CHF care management programs, as described in this article, included which of the following characteristics?
 - a) Lack of structured patient monitoring.
 - b) Inappropriate sample sizes for statistical analyses.
 - c) Inappropriate patient selection (too sick or too well to benefit from the intervention).
 - d) All of the above.
7. **TRUE OR FALSE.** Studies suggest that structured, standardized interventions performed by personnel who are experienced in cardiovascular disease are useful components in CHF care management programs.
 - a) True
 - b) False
8. **CHOOSE ONE.** Which of the following is true regarding CHF care management programs for older adults?
 - a) Electronic monitoring has proved superior to routine outpatient follow-up in reducing hospital admissions.
 - b) Pharmaceutical costs may increase as a result of a care management intervention.
 - c) The number of outpatient visits always increases.
 - d) Several studies reported decreased quality-of-life scores among participants.
9. **TRUE OR FALSE.** There is consensus regarding the essential components of CHF care management programs for older patients.
 - a) True
 - b) False
10. **CHOOSE ONE.** In this article, which of the following was not a recommended intervention for CHF care management programs for older adults?
 - a) Pairing a physician and nurse who understand the medical and nonmedical needs of older patients with CHF.
 - b) Consultations as needed with dietitians, social workers, and therapists.
 - c) Home visits for all patients older than 75 years.
 - d) Education supplemented with regularly scheduled follow-up.

CONTINUING MEDICAL EDUCATION QUIZ

Activity Evaluation Form

Please rate the degree to which the learning objectives for this activity were met:

Objective 1. Identify CHF care management strategies and outcome measures that have been investigated in published studies.

Not at all 1 2 3 4 Completely 5

Objective 2. Assess the potential effectiveness of the various published care management strategies for CHF in older patients.

Not at all 1 2 3 4 Completely 5

Objective 3. Determine whether any strategy or combination of strategies seems particularly beneficial based on published reports.

Not at all 1 2 3 4 Completely 5

Objective 4. Comment on those outcome measures that are most likely to be helpful in determining the overall clinical

efficacy and cost-effectiveness of care management for older patients with CHF.

Not at all 1 2 3 4 Completely 5

Was this activity relevant to your practice needs?

Not at all 1 2 3 4 Completely 5

Will your practice of medicine change as a result of participating in this activity?

Not at all 1 2 3 4 Completely 5

Comments: _____

This activity was objective, scientifically rigorous, and free of commercial bias:

Not at all 1 2 3 4 Completely 5

Please suggest specific educational topics or practice-related problems that you would like to see addressed in future CME activities:

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Quiz

I would would not be willing to participate in a brief follow-up survey to determine whether this activity has had any long-term impact on my practice.

The University of Pennsylvania School of Medicine designates this activity for a maximum of 1 category 1 credit toward the AMA Physician's Recognition Award. Each physician should claim only those credits that he/she actually spent in the activity.

I certify that I have participated in the CME-certified journal article titled *Care Management Interventions for Older Patients With Congestive Heart Failure* for a total of _____ hours.

SIGNATURE _____

DATE _____

Please circle your answers:

- | | |
|------------|-------------|
| 1. a b | 6. a b c d |
| 2. a b c d | 7. a b |
| 3. a b | 8. a b c d |
| 4. a b | 9. a b |
| 5. a b c d | 10. a b c d |