

## A Community Hospital-Based Congestive Heart Failure Program: Impact on Length of Stay, Admission and Readmission Rates, and Cost

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### **Abstract**

**Objective:** To do an analysis of patients with a primary diagnosis of congestive heart failure at discharge before (n = 407) and after (n = 347) the implementation of a comprehensive inpatient and outpatient congestive heart failure program consistent with the guidelines of the Agency for Health Care Policy and Research.

**Study Design:** A retrospective analysis of the impact of the congestive heart failure program on length of stay, admission and readmission rates, and costs to both patient and provider. The program, which used a multidisciplinary team approach, included an intensive education program focusing on diet, compliance, and symptom recognition, as well as the use of outpatient infusions. It also incorporated aggressive pharmacologic treatment for patients with advanced congestive heart failure.

**Results:** Our analysis revealed significant decreases in length of stay, admission and readmission rates, and costs to the patient and provider ( $P \leq .05$ ). The mean cost per admission decreased 17% (\$1118), and a substantial 77% (\$718,468) net reduction in nonreimbursed (lost) hospital revenue was noted.

**Conclusion:** A multidisciplinary, comprehensive congestive heart failure program can improve patient care in a community-hospital setting while significantly reducing costs to both the patient and the institution.

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Congestive heart failure (CHF) is a serious and growing medical problem, with about 400,000 new cases diagnosed yearly.<sup>1</sup> In the United States alone, more than 4 million patients have symptoms of this disease.<sup>2</sup> CHF is now the leading hospital discharge diagnosis for patients older than 65 years of age.<sup>2,3</sup> Moreover, the incidence of CHF is increasing at a rate 10-fold higher in patients older than 75 than in younger patients.<sup>4</sup> Among the elderly, the rate of readmission because of CHF within 3 to 6 months of initial discharge has been reported to range from 29% to 36%.<sup>5,6</sup> The average length of stay per hospital admission for this disease is about 7 days, with a mean cost per hospitalization of \$5100.<sup>7</sup> In 1990, over 700,000 patients were hospitalized with CHF at a total cost of almost \$10 billion.<sup>8</sup> The result is a tremendous financial burden on healthcare providers and the health insurance system.

In patients with less severe CHF (New York Heart Association classes I and II), a treatment regimen that includes a vasodilator such as an angiotensin-converting enzyme inhibitor, a diuretic, and digitalis may be sufficient to control the symptoms and functional deterioration that necessarily accompany disease progression. However, the reported rates of medication noncompliance, implicated as a significant cause for rehospitalization in these patients, range from 20% to 58%.<sup>9-11</sup> In patients with advanced CHF (New York Heart Association classes III and IV) receiving maximum doses of conventional medication, more aggressive therapy is warranted. Intravenous agents such as milrinone and dobutamine have been effective in the treatment of decompensated CHF when administered as intermittent therapy in an outpatient clinic setting.<sup>12</sup>

To address some of the weaknesses in the current management of CHF, the Agency for Health Care Policy and Research (AHCPR) has released guidelines that not only advocate a comprehensive, multidisciplinary approach to the treatment of CHF but also suggest that medications used to control the symptoms of CHF are often underused.<sup>13</sup> Thus far, only a small

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number of hospitals have established outpatient CHF clinics for the multidisciplinary cardiac care of these patients. Outpatient clinics offer an alternative to conventional therapy by using a team approach to provide specialized clinical expertise, aggressive pharmacologic therapy, and preventive care in conjunction with the primary care physician.<sup>14</sup>

In July 1994, the community-based Elmhurst Memorial Hospital in Elmhurst, Illinois, implemented a new comprehensive inpatient and outpatient program embracing the AHCPR guidelines. The program uses a multidisciplinary team approach and incorporates aggressive pharmacologic treatment for patients with advanced CHF. The goal is to reduce the cost of

patient care by decreasing the length of stay and breaking the cycle of readmissions. We report the results of a retrospective analysis of the impact of this CHF program on length of stay, admission and readmission rates, and costs to both patient and provider.

... METHODS ...

**Patients**

Patients with a primary diagnosis of CHF (diagnosis-related group 127 [DRG-127]) at discharge were included in this retrospective analysis. The control group comprised 407 patients treated before program initiation during the period of July 1993 to June 1994. The program group comprised 347 patients treated in the program during the period of July 1994 to June 1995. A subset of these patients (n = 81) received outpatient intravenous inotropic therapy. Acute indications for this therapy were (1) failure to respond to outpatient oral therapy and evidence of decompensation and/or (2) presentation to the emergency department with symptoms of decompensation or heart failure that were considered by the cardiologist to respond to 4 to 6 hours of inotropic therapy, thus avoiding inpatient admission. Chronic indications included known New York Heart Association class III or IV heart failure and the presence of one or more of the following: recurrent hospital admissions during the preceding year, noncompliance with prescribed medical regimen, and/or lower economic status.

**Protocol**

In light of diverse physician practices, inpatient and outpatient heart failure treatment protocols were established. These protocols were implemented by a multidisciplinary team consisting of a cardiologist director, clinical nurse specialist, two registered nurses, and a patient care technician, as well as a dietitian and social worker on consultation. Table 1 summarizes the points addressed in the 4-day inpatient clinical path, which allows the medical staff to monitor the progress and timeliness of interventions followed in this protocol. Patients at high risk for decompensation were referred to an outpatient hospital-based CHF clinic for administration of intermittent intravenous inotropes. The outpatient protocol is shown in Table 2.

The program was characterized by a multidisciplinary approach designed to address the educational needs of the medical and nursing staff, the patient, and the family. Physician training was accomplished at medical staff meetings by presenting protocols to the departments of internal medicine, family practice, and cardiology. An in-depth overview was presented and included a review of inpatient and

**Table 1.** Heart Failure Clinical Path\*

<b>Consultations</b>
Cardiology
Dietary
Social/pastoral services
Clinical nurse specialist
<b>Tests/Treatments</b>
Laboratory blood analysis
Assessment of left ventricular function (if not performed in past 6 months)
Daily weight
Strict intake and output
Continuous cardiac monitoring
Intravenous access
<b>Medications</b>
Angiotensin-converting enzyme inhibitor
Other vasodilators
Diuretics
Digoxin
Intravenous inotropes
<b>Dietary</b>
Sodium restriction
Fluid restriction
<b>Activity</b>
Progressive cardiac rehabilitation
<b>Education</b>
Signs and symptoms
Medications
Diet
Exercise
<b>Discharge Planning</b>
Daily multidisciplinary rounds
Outpatient heart failure center
Home health
Support group

\*Expected length of stay: 4 days

outpatient standing orders, clinical paths, services available for heart failure patients, and patient education materials.

The nursing staff was educated through multiple unit in-service sessions comprising a review of the pathophysiology of heart failure, the rationale for drug therapy, the financial impact of CHF on the institution, the use of standing orders and clinical paths to guide treatment, and critical elements of the CHF program regimen (eg, recording of the patient's daily weight, monitoring of sodium, and fluid restrictions). In addition, one-on-one meetings were held between staff nurses and the nursing representative from a continuous-improvement process committee.

Intensive patient and family education was provided, emphasizing recognition of the signs and symptoms of decompensated heart failure, the importance of taking medication as prescribed by the physician, and the benefits of sodium restriction and regular exercise. A written medication schedule with specific instructions and a weight recording chart were given to each patient before discharge. All patients received follow-up telephone contacts on a weekly basis for 1 month and every other week thereafter for a minimum of 90 days after discharge to evaluate their symptoms and to encourage compliance with the home management regimen for CHF.

### Outcome Measures

The primary endpoint for this analysis was length of stay for all CHF-related admissions. Secondary endpoints were the primary admission rate for CHF, the readmission rate within 90 days of discharge, and the per-case cost to the patient and provider for all CHF admissions.

### Data Analysis

Results were compared for patients before and after the implementation of the CHF program. Individual patient costs were evaluated by examining the total hospitalization costs on a per-case basis. Costs to the institution were evaluated by comparing the average total net nonreimbursed (lost) hospital revenue for CHF treatment before and after program implementation. Continuous variables were analyzed by using the Student *t* test, and categorical data were evaluated by the chi-square test or the Fisher exact test. Results are expressed as mean  $\pm$  SD unless otherwise specified. All comparisons were two-tailed with statistical significance defined as  $P \leq 0.05$ .

## ... RESULTS ...

### Baseline Characteristics

Baseline characteristics of a random sample of patients treated before program implementation were compared with baseline characteristics of a random sample of patients treated after program implementation (see Table 3). This 20% random sampling was performed by using a computer-generated table of causal numbers. Comparable mean age and sex distributions were seen in the control (74.39 years, 50% male) and treatment (75.8 years, 42% male) groups. Both groups were well balanced with respect to most baseline characteristics, including admission

**Table 2.** Outpatient Protocol for Treatment of Congestive Heart Failure

1.	Record weight pre- and postinfusion
2.	Record intake and output, as needed.
3.	Record vital signs at baseline (admission) and during infusion. <ul style="list-style-type: none"> <li>• Every 30 min <math>\times</math> 2</li> <li>• Every 1 h until discharge</li> <li>• As required</li> </ul>
4.	Initiate continuous electrocardiographic monitoring.
5.	Monitor activity (ad lib)
6.	Institute diet restrictions: Sodium 2 g/day maximum with other restrictions as they are at home.
7.	Administer oxygen at 2-4 L per nasal cannula, as needed.
8.	Order laboratory tests as needed. <ul style="list-style-type: none"> <li>• Intravenous screen.</li> <li>• Prothrombin time/international normalized ratio.</li> </ul>
9.	Administer home medications as needed.
10.	Administer intravenous inotropic therapy: <ul style="list-style-type: none"> <li>• Dobutamine: _____ <math>\mu\text{g}/\text{kg}/\text{min}</math> for _____ h</li> <li>• Milrinone: Loading dose of _____ <math>\mu\text{g}/\text{kg}</math> over 10 min, followed by 0.375 <math>\mu\text{g}/\text{kg}/\text{min}</math> for _____ h and/or 0.5 <math>\mu\text{g}/\text{kg}/\text{min}</math> for _____ h</li> </ul>
11.	Schedule as outpatient _____ time(s) a wk.
12.	Obtain most recent echocardiogram, stress test, and/or cardiac catheterization report(s) from cardiac diagnostics.
13.	Obtain most recent multiple-gated acquisition report from nuclear medicine.
14.	Notify primary care physician.

blood pressure, ejection fraction, critical laboratory parameters, and comorbidity. However, the control group had a higher incidence of previous CHF (76% vs 59%;  $P = 0.04$ ). Most patients in both groups were receiving maximal conventional therapy, including digoxin, loop diuretics, and angiotensin-converting enzyme inhibitors. However, intravenous inotropes were administered to more control patients during their acute hospitalization period (31% vs 22%;  $P = 0.05$ ). Also, more patients in the CHF program group were treated with  $\beta$ -blockers (12% vs 4%;  $P = 0.04$ ). Of the 347 patients in the program group, 81 (23%) received intermittent outpatient inotropic therapy.

**Length of Stay**

The program group had a significantly reduced length of stay compared with the control group ( $5.7 \pm 4.8$  days

vs  $7.3 \pm 5.8$  days;  $P = 0.05$ ) (Figure 1). This difference represents a 22% reduction in the mean duration of hospitalization. Because the mean length of stay for each of 3 consecutive years before implementation of the program consistently exceeded 7 days, the decrease could not be attributed solely to a national annual decline in length of hospitalization.

**Admission and Readmission Rates**

The control group had 503 primary hospital admissions ( $n = 407$ ) for CHF management, compared with 404 ( $n = 347$ ) in the program group ( $P = 0.05$ ). In contrast, no similar trend was witnessed in the 2 years before this analysis, during which there had been a 20% increase in heart failure admissions. After discharge, there was also a significant difference in the 90-day readmission rate ( $P = 0.05$ ), with 18% of the

**Table 3.** Baseline Characteristics of Study Patients Before and After Implementation of Congestive Heart Failure Program\*

Characteristic	Control Group (n = 407)	Program Group (n = 347)	P value
Systolic blood pressure (mm Hg)	140.3 ± 31.2	143.1 ± 32.0	NS
Diastolic blood pressure (mm Hg)	80.4 ± 18.7	79.3 ± 18.1	NS
Peak sodium (mmol/L)	144.1 ± 4.2	145.0 ± 3.5	NS
Peak blood urea nitrogen (mg/dL)	38.9 ± 22.5	36.3 ± 22.4	NS
Peak creatinine (mg/dL)	2.0 ± 1.6	1.7 ± 1.0	NS
Ejection fraction (%)	34.6 ± 13.7	37.9 ± 14.9	NS
Hypertension (% patients)	60	55	NS
Diabetes mellitus (% patients)	47	45	NS
Prior congestive heart failure (% patients)	76	59	0.04
Prior myocardial infarction (% patients)	50	41	NS
Prior revascularization (% patients)	23	25	NS
Prior chronic obstructive pulmonary disease (% patients)	24	33	NS
Prior renal failure (% patients)	26	20	NS
Medications taken (% patients)			
In-hospital intravenous inotropes	31	22	0.05
Digoxin	60	61	NS
Diuretics	86	77	NS
Angiotensin-converting enzyme inhibitors	63	59	NS
Nitrates	36	38	NS
Hydralazine	3	4	NS
$\beta$ -blockers	4	12	0.04

NS = not significant.

\*Patients who were treated during both intervals were excluded before sampling.

patients in the control group and 13% in the program group being rehospitalized in our institution at least once for management of CHF during the 90-day follow-up period.

### Costs

Medical costs were analyzed before and after implementation of the CHF program from two perspectives: cost to the patient and cost to the institution. Mean cost per admission was significantly reduced from \$6719 in the control group to \$5601 in the program group (Figure 2), reflecting a net reduction in cost of 17% (or \$1118) per admission ( $P = 0.006$ ). The mean total net revenue lost by the hospital for CHF decreased by 77% (or to \$216,226) after program implementation (Figure 3). The lost hospital revenue per hospitalization decreased from \$1876 to \$535, a reduction of 71% (or \$1341) per case. The cost of operating the outpatient heart failure center was approximately \$104,000; the revenue generated by this program was \$211,000.

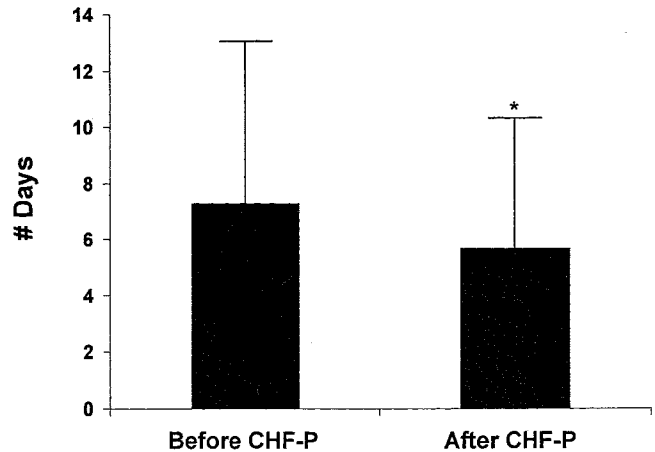
### ... DISCUSSION ...

As the number of patients with CHF continues to rise, management of the disease will consume an ever-increasing share of the healthcare dollar. To address this growing healthcare problem, guidelines such as those proposed by AHCPR have been developed. However, little information has been published about the impact of their implementation on the cost of CHF management to patients and healthcare providers. This study demonstrates that length of stay, readmission rate, and hospital costs can be reduced in a community-hospital setting by a physician-directed, nurse-managed, multidisciplinary CHF program based on the AHCPR guidelines. These findings confirm previous reports suggesting that participation in comprehensive heart failure management programs can produce dramatic reductions in hospitalizations and improve functional capacity.<sup>15</sup>

### Costs

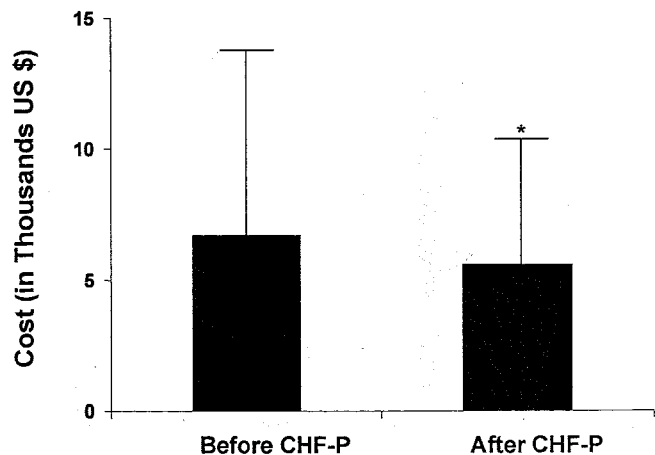
The central finding of this study was that participation in a comprehensive CHF program reduced both patient and provider costs. Total and nonreimbursable costs per patient decreased significantly after program implementation because of reduced admission and readmission

**Figure 1.** Length of Stay Before and After Implementation of the Congestive Heart Failure Program (CHF-P)



\* $P = 0.05$ .

**Figure 2.** Mean Cost per Admission Before and After Implementation of the Congestive Heart Failure Program (CHF-P)



\* $P = 0.006$ .

rates and decreased length of stays. The clinical significance of these findings will become increasingly clear as more people develop CHF, thus placing added pressure on Medicare and other health insurance systems to restrain costs.

### Infusion Therapy

The role of intermittent outpatient infusion of inotropic agents in the management of CHF is yet to be determined. These infusions can be effective in the control of symptoms in patients with advanced heart failure. Reports in the literature indicate that use of phosphodiesterase inhibitors and catecholamines may improve functional capacity, exercise tolerance, and quality of life and also reduce hospital admissions and length of stay.<sup>16-18</sup> In contrast, a preliminary report on patients receiving intermittent inotropic infusions 48 hours per week in an outpatient, unmonitored setting noted an improvement in symptoms but an increase in mortality, probably of arrhythmogenic origin.<sup>19</sup> Approximately 15% to 20% of heart failure patients receive intermittent inotropic infusions; these

patients either are considered to be at high risk for readmission (age more than 70 years, with multiple comorbidities, compromised ejection fraction, borderline hemodynamics, poor social situation, or demonstrated noncompliance) or have been admitted for CHF once within the past year. Treatment sessions for intermittent infusions can facilitate close patient follow-up and observation in a high-risk population, by extending and reinforcing patient education and use of oral medication regimens. Early signs and symptoms of decompensation are readily detected; thus, intervention to prevent admission can be initiated.

### Patient Education

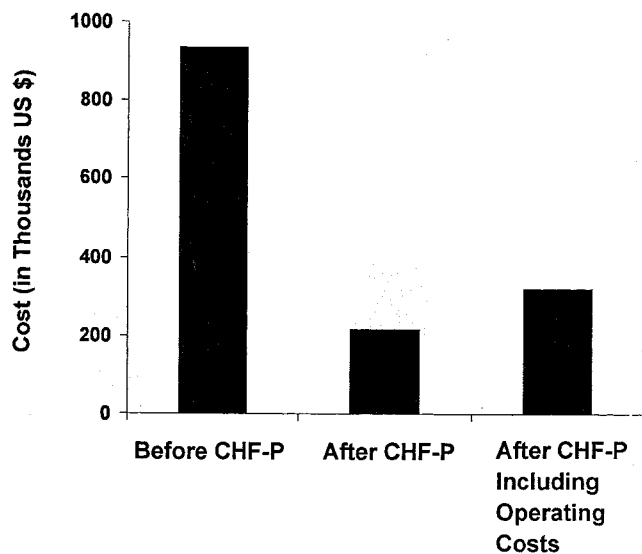
All patients in the program group met with an advanced practice nurse who instructed them about their disease and reinforced the importance of adhering to prescribed medication regimens, diet, and exercise routines. These patients also were taught how to recognize the prodromal signs of disease exacerbation such as weight gain and dyspnea, as well as the importance of reporting these changes to physicians. Whenever possible, the entire family was involved in this process.

Rehospitalization of elderly patients with CHF may be prevented in up to 50% of cases.<sup>14,20</sup> Preventable factors contributing to hospital readmission include noncompliance with medication regimen or diet, inadequate discharge planning or follow-up, poor social support systems, and failure to seek medical attention promptly when symptoms recur. Our CHF program implemented a means of early identification and remediation through close patient monitoring and education.

### Study Limitations

This study was nonrandomized and compared costs during consecutive years before and after program implementation. Therefore, it is subject to possible biases resulting from changes in patient population and physician practice patterns. A 20% random sampling technique was used to compare baseline characteristics between the two groups, and baseline differences existed. The control group had a higher incidence of previous CHF and received intravenous inotropic therapy more frequently during acute hospitalizations. Use of  $\beta$ -blockers in the program group was higher. Other baseline patient characteristics were not significantly different between control and program groups.

**Figure 3.** Cost (as Total Net Nonreimbursed Hospital Revenue for DRG-127) to Institution 1 Year Before Implementation of Congestive Heart Failure Program (CHF-P), 1 Year After Implementation of CHF-P, And 1 Year After Implementation of CHF-P Inclusive of the Cost of the CHF-P Operation



... CONCLUSIONS ...

Our data and those in the literature support an important role for heart failure centers that offer a comprehensive, multidisciplinary approach to treating CHF. This approach should include close patient monitoring, physician and patient education, and aggressive pharmacologic treatment. Such centers offer a practical solution to the escalating costs of CHF management and can be implemented easily in a community hospital-based setting. In an age of managed care and cost-conscious resource allocation, heart failure centers hold the promise of reducing costs while improving patient care in the treatment of CHF.

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