

A MULTIDISCIPLINARY INTERVENTION TO PREVENT THE READMISSION OF ELDERLY PATIENTS WITH CONGESTIVE HEART FAILURE

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Abstract *Background.* Congestive heart failure is the most common indication for admission to the hospital among older adults. Behavioral factors, such as poor compliance with treatment, frequently contribute to exacerbations of heart failure, a fact suggesting that many admissions could be prevented.

Methods. We conducted a prospective, randomized trial of the effect of a nurse-directed, multidisciplinary intervention on rates of readmission within 90 days of hospital discharge, quality of life, and costs of care for high-risk patients 70 years of age or older who were hospitalized with congestive heart failure. The intervention consisted of comprehensive education of the patient and family, a prescribed diet, social-service consultation and planning for an early discharge, a review of medications, and intensive follow-up.

Results. Survival for 90 days without readmission, the primary outcome measure, was achieved in 91 of the 142 patients in the treatment group, as compared with 75 of the 140 patients in the control group, who re-

ceived conventional care ($P=0.09$). There were 94 readmissions in the control group and 53 in the treatment group (risk ratio, 0.56; $P=0.02$). The number of readmissions for heart failure was reduced by 56.2 percent in the treatment group (54, vs. 24 in the control group; $P=0.04$), whereas the number of readmissions for other causes was reduced by 28.5 percent (40 vs. 29, P not significant). In the control group, 23 patients (16.4 percent) had more than one readmission, as compared with 9 patients (6.3 percent) in the treatment group (risk ratio, 0.39; $P=0.01$). In a subgroup of 126 patients, quality-of-life scores at 90 days improved more from base line for patients in the treatment group ($P=0.001$). Because of the reduction in hospital admissions, the overall cost of care was \$460 less per patient in the treatment group.

Conclusions. A nurse-directed, multidisciplinary intervention can improve quality of life and reduce hospital use and medical costs for elderly patients with congestive heart failure. (N Engl J Med 1995;333:1190-5.)

CONGESTIVE heart failure is the most common indication for hospitalization among adults over 65 years of age,¹ and the rate of admission to treat this condition has increased progressively over the past two decades.² Elderly patients with heart failure are also at increased risk for early rehospitalization, with rates of readmission ranging from 29 to 47 percent within three to six months of the initial discharge.³⁻⁵ Moreover, behavioral factors, such as noncompliance with medications and diet, and social factors, such as social isolation, frequently contribute to early readmissions, suggesting that many such readmissions could be prevented.^{5,6}

We hypothesized that a multidisciplinary approach to treatment could significantly reduce the rate of readmission for elderly patients at high risk, and we conducted a feasibility study to evaluate this hypothesis.⁷ In that study 98 patients 70 years of age or older who were hospitalized with congestive heart failure were randomly assigned to receive either the study treatment or conventional care. During a 90-day period of follow-up, the treatment group had a 27 percent reduction in the readmission rate, but the reduction was not statistically significant.⁷ We then conducted a prospective, randomized trial of 282 patients, described in this report, to assess the effect of the intervention on the rate of readmission, quality of life, and the overall cost of medical care.

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METHODS

Patients

All patients 70 years of age or older who were admitted to the medical wards of Jewish Hospital at Washington University Medical Center were screened for congestive heart failure. For a diagnosis of heart failure, either definite radiographic evidence of pulmonary congestion or typical symptoms and signs of heart failure in conjunction with definite clinical improvement in response to diuresis were required. Patients with confirmed heart failure were eligible to participate in the study if they had at least one of the following risk factors for early readmission, as determined in a previous study⁵: prior history of heart failure, four or more hospitalizations for any reason in the preceding five years, or congestive heart failure precipitated by either an acute myocardial infarction or uncontrolled hypertension (systolic blood pressure ≥ 200 mm Hg or diastolic blood pressure ≥ 105 mm Hg). The criteria for exclusion from the study included residence outside the catchment area of Jewish Hospital Home Care, planned discharge to a long-term-care facility, severe dementia or other serious psychiatric illness, anticipated survival of less than three months, refusal to participate by either the patient or the physician, and logistic or discretionary reasons (including participation in the pilot study⁷). The study was approved by the institutional review board of Jewish Hospital, and all patients provided informed consent.

A total of 1306 patients 70 or more years of age met the criteria for congestive heart failure from July 1990 through June 1994. Among them, 391 (29.9 percent) were excluded because they had no risk factors for early readmission. An additional 633 patients were excluded because they lived outside the catchment area (141 patients), because discharge to a long-term-care facility was planned (114), because they had dementia or psychiatric illness (19) or terminal illness (68), because the patient or the physician decided not to participate (116), or for logistic or discretionary reasons (175), most commonly the inability to complete enrollment before discharge.

Randomization and Study Treatment

The patients underwent blinded randomization with the use of a computer-generated list of random numbers immediately after consenting to participate in the study. Neither the patient nor the members of the study team were aware of the treatment assignment until after randomization.

The study treatment consisted of intensive education about congestive heart failure and its treatment by an experienced cardiovascular research nurse, using a teaching booklet developed by the study investigators for geriatric patients with heart failure; individualized dietary assessment and instruction given by a registered dietitian with reinforcement by the study nurse; consultation with social-service personnel to facilitate discharge planning and care after discharge; an analysis of medications by a geriatric cardiologist who made specific recommendations to eliminate unnecessary medications and simplify the overall regimen; and intensive follow-up after discharge through the hospital's home care services, supplemented by individualized home visits and telephone contact with the members of the study team. The principal goals of follow-up were to reinforce the patient's education, ensure compliance with medications and diet, and identify recurrent symptoms amenable to treatment on an outpatient basis. Additional details about the intervention have been published previously.⁷

Patients assigned to conventional care (the control group) were eligible to receive all standard treatments and services ordered by their primary physicians. In no case was standard or generally accepted therapy withheld.

Data Collection and Follow-up

Detailed data were collected at the time of enrollment, including demographic and psychosocial information; items pertaining to the patient's medical history, physical examination, and laboratory evaluation; results of cardiac tests; and pertinent information pertaining to the hospital course. All patients were followed for 90 days after discharge. For patients rehospitalized during follow-up, data on the cause of readmission, the contributing factors, and information on the hospital course during readmission were obtained. To minimize the burden placed on participating patients, data on quality of life and costs were collected only for subgroups, as described below.

Quality of Life

Quality of life as the patient perceived it was assessed at base line and at three months in 126 patients with the Chronic Heart Failure Questionnaire.⁸ This instrument consists of 20 items that the patient was asked to rate on a scale from 1 (lowest) to 7 (highest); there are four subscales: dyspnea (containing 4 items), fatigue (5 items), emotional function (7 items), and environmental mastery (4 items). Previous studies have shown this questionnaire to be responsive to quality-of-life changes in patients with heart failure.^{8,9}

Cost Analysis

Detailed data on all medical costs and costs for care givers were collected prospectively, with cost logs, for 57 patients during the final year of the study. The logs were checked regularly for accuracy by study nurses. Logs were also maintained by the study personnel to determine the cost of the treatment, exclusive of costs for research and monitoring (i.e., screening, randomization, data collection, and follow-up). An hourly rate of \$20 was chosen as the cost of nursing time (including direct contact with the patient, travel, and telephone calls), as well as for time spent by the dietitian, social worker, and home care team. An hourly rate of \$6 was chosen as the cost of time spent by unpaid care givers (i.e., spouses, family, and friends). Costs for hospital admissions were based on the allowed reimbursements provided according to standard codes for each diagnosis-related group (DRG). To calculate the overall cost of medical care during the 90-day follow-up period, the mean cost of readmission for all patients in each group was added to the average cost for nonhospital medical services and care givers, and, in the treatment group, for the intervention. All costs were adjusted to 1994 dollars.

Study End Points and Statistical Analysis

All the analyses were conducted according to the intention-to-treat principle, with survival for 90 days without readmission as the primary, prespecified outcome measure. Secondary end points included the number of readmissions for any cause, the number of readmis-

sions for congestive heart failure, the cumulative number of days of hospitalization during follow-up, quality-of-life scores, and the overall cost of medical care.

The two study groups were compared by Student's *t*-test (two-tailed) for normally distributed continuous variables, by the chi-square test for discrete variables, and by the Wilcoxon rank-sum test for categorical variables and continuous variables not normally distributed. Stepwise proportional-hazards regression was used to identify predictors of readmission within 90 days of discharge from the hospital. A backward, sequential survival analysis was performed with the Cox proportional-hazards model to determine whether the treatment assignment was an independent predictor of readmission after adjustment for other relevant covariates.¹⁰ Kaplan-Meier survival curves were constructed to assess the probability of survival without readmission during the follow-up period. In both the Cox and the Kaplan-Meier analyses, data on patients who died without readmission to the hospital were censored at the time of death. Risk ratios and 95 percent confidence intervals were calculated, when appropriate, to compare outcomes between groups.¹¹ A *P* value of less than 0.05 was considered to indicate statistical significance in the major comparisons between groups. The results are expressed as means \pm SD unless otherwise specified.

RESULTS

Base-Line Characteristics

The base-line characteristics of the study patients are shown in Table 1. The median age of the patients was 79 years; 63 percent were women, and 45 percent were white (except for two Asians, the remainder were black). The two groups were well balanced with respect to most base-line characteristics, including New York Heart Association functional class and left ventricular ejection fraction. The patients in the treatment group were somewhat older and better educated, however. They also had higher heart rates on the base-line electrocardiogram and were more likely to have undergone previous coronary-artery revascularization. It is important to note, however, that none of those variables had a significant effect on the rate of readmission.

Event-free Survival

As Table 2 shows, 17 patients in the control group (12.1 percent) died during the study period, as compared with 13 patients in the treatment group (9.2 percent). Survival for 90 days without readmission, the primary end point, occurred in 75 patients in the control group (53.6 percent), as compared with 91 patients in the treatment group (64.1 percent), but this difference was not significant (absolute difference, 10.5 percent; 95 percent confidence interval, -0.9 to +21.9 percent; percent difference, 19.6 percent; *P* = 0.09). When the analysis was restricted to survivors of the initial hospitalization, however, a significant difference in survival for 90 days without readmission was noted (54.3 percent in the control group vs. 66.9 percent in the treatment group; 95 percent confidence interval for the difference, 1.1 to 24.1 percent; *P* = 0.04).

Readmissions

As Table 2 and Figure 1 show, 59 patients in the control group (42.1 percent) had at least one readmission during follow-up, as compared with 41 patients in the

treatment group (28.9 percent; absolute reduction, 13.2 percent; 95 percent confidence interval, 2.1 to 24.3 percent; $P=0.03$). Multiple readmissions were more frequent in the control group (16.4 percent, vs. 6.3 percent in the treatment group; 95 percent confidence interval for the difference, 2.8 to 17.4 percent; $P=0.01$), so that the total number of readmissions during follow-up was reduced by 44.4 percent ($P=0.02$). Similarly, the total number of days of hospitalization was reduced from 865 in the control group to 556 in the treatment group, for a net reduction in hospital use of 35.7 percent ($P=0.04$).

Overall, 78 of the 147 readmissions were for recurrent heart failure (53.1 percent). In the control group, there were 54 readmissions due to heart failure, as

Table 1. Base-Line Characteristics of the Study Patients.*

| CHARACTERISTIC | CONTROL GROUP (N = 140) | TREATMENT GROUP (N = 142) | P VALUE |
|---|----------------------------|------------------------------|---------|
| Age (yr) | 78.4±6.1 | 80.1±5.9 | 0.02 |
| Female sex | 83 (59) | 96 (68) | NS |
| Nonwhite race | 82 (59) | 74 (52) | NS |
| Married | 46 (33) | 53 (37) | NS |
| Living alone | 62 (44) | 58 (41) | NS |
| Education ≤8th grade | 67 (48) | 49 (35) | 0.03 |
| Hypertension | 111 (79) | 103 (73) | NS |
| Diabetes mellitus | 41 (29) | 39 (27) | NS |
| Prior congestive heart failure | 113 (81) | 105 (74) | NS |
| Prior myocardial infarction | 62 (44) | 59 (42) | NS |
| Prior revascularization | 18 (13) | 38 (27) | 0.005 |
| Ischemic cause of heart failure | 82 (59) | 77 (54) | NS |
| NYHA class | 2.4±1.1 | 2.4±1.0 | NS |
| Medications taken | | | |
| Digoxin | 53 (38) | 51 (36) | NS |
| Diuretic | 117 (84) | 119 (84) | NS |
| Angiotensin-converting-enzyme inhibitor | 89 (64) | 77 (54) | NS |
| Nitrates | 100 (71) | 90 (63) | NS |
| Beta-blocker | 16 (11) | 18 (13) | NS |
| Calcium antagonist | 58 (41) | 53 (37) | NS |
| Activities-of-daily-living score† | 5.6±1.1 | 5.5±1.2 | NS |
| Short Blessed score‡ | 8.0±7.1 | 6.8±6.2 | NS |
| Body-mass index§ | 25.8±6.5 | 25.4±5.1 | NS |
| Systolic blood pressure (mm Hg) | 157±35 | 159±38 | NS |
| Hemoglobin (g/dl) | 11.9±1.9 | 12.3±1.8 | NS |
| Blood urea nitrogen (mg/dl) | 30±19 | 29±18 | NS |
| Creatinine (mg/dl) | 1.8±1.0 | 1.6±0.8 | NS |
| Sodium (mmol/liter) | 139±4 | 139±3 | NS |
| Albumin (g/dl) | 3.7±0.4 | 3.8±0.4 | NS |
| Cholesterol (mg/dl) | 190±55 | 202±56 | NS |
| Electrocardiographic measures | | | |
| Heart rate (per min) | 85±19 | 91±21 | 0.02 |
| Nonsinus rhythm | 35 (25) | 44 (31) | NS |
| Ejection fraction (%¶) | 41±13 | 44±14 | NS |

*Plus-minus values are means ±SD. Values followed by a number in parentheses are numbers of patients and percentages of the group. NS denotes not significant, and NYHA New York Heart Association. To convert values for urea nitrogen to millimoles per liter, multiply by 0.357; to convert values for creatinine to micromoles per liter, multiply by 88.4; to convert values for cholesterol to millimoles per liter, multiply by 0.02586.

†Scored on a six-point scale.

‡Denotes scores on the short version of the Blessed Dementia Scale, with higher scores indicating more severe cognitive impairment.

§Calculated as the weight in kilograms divided by the square of the height in meters.

¶Data on ejection fraction were available for 222 patients (79 percent).

Table 2. Readmission and Death within 90 Days of Initial Discharge from the Hospital.*

| VARIABLE | CONTROL GROUP (N = 140) | TREATMENT GROUP (N = 142) | DIFFERENCE† (%) | P VALUE |
|------------------------------------|----------------------------|------------------------------|--------------------|----------------|
| Patients readmitted (no. of times) | | | | |
| ≥1 | 59 (42.1) | 41 (28.9) | -31.5 | 0.03 |
| ≥2 | 23 (16.4) | 9 (6.3) | -61.4 | 0.01 |
| No. of readmissions | 94 | 53 | -44.4 | 0.02‡ |
| For CHF | 54 | 24 | -56.2 | 0.04‡ |
| Not for CHF | 40 | 29 | -28.5 | NS |
| Hospital days | | | | |
| All | 865 | 556 | -35.7 | Not applicable |
| Per patient | 6.2±11.4 | 3.9±10.0 | -36.6 | 0.04‡ |
| Deaths from any cause | 17 (12.1) | 13 (9.2) | -24.6 | NS |
| In hospital | 2 (1.4) | 6 (4.2) | — | NS |
| After discharge | 15 (10.7) | 7 (4.9) | — | NS |
| Survival without readmission | 75 (53.6) | 91 (64.1) | +19.6 | 0.09 |
| Death without readmission | 6 (4.3) | 10 (7.0) | — | NS |

*Plus-minus values are means ±SD. Values followed by a number in parentheses are numbers of patients and percentages of the group. CHF denotes congestive heart failure, and NS not significant.

†Percent differences were calculated by dividing the absolute percent difference between groups by the control-group percentage.

‡By the Wilcoxon rank-sum test.

compared with only 24 in the treatment group (risk ratio, 0.44; $P=0.04$). Readmissions for reasons other than heart failure were also more frequent in the control group (40 vs. 29; risk ratio, 0.71), but this difference was not significant.

To determine whether assignment to the treatment group was associated with a reduced rate of readmission after adjustment for base-line differences between groups and other prognostic factors, we constructed a Cox proportional-hazards model. As Table 3 shows, the strongest independent predictors of readmission were higher blood urea nitrogen level, higher systolic blood pressure, higher serum sodium level, and presence of diabetes mellitus. After adjustment for these variables as well as for other univariate predictors of readmission, assignment to the control group remained a significant independent predictor of rehospitalization.

Quality of Life

Table 4 shows base-line and three-month scores on the Chronic Heart Failure Questionnaire administered to 126 patients. Although the quality of life improved in both groups, there was significantly more improvement in the treatment group ($22.1±20.8$ vs. $11.3±16.4$, $P=0.001$). In addition, quality of life improved consistently on each of the four subscales among the patients receiving the treatment (range, 52 percent to 195 percent). During the 90-day follow-up period, 11 patients were admitted to long-term care facilities (5 in the treatment group and 6 in the control group).

Cost of Care

The average cost of the study intervention was \$216 per patient (Table 5). Two thirds of this amount was spent on nursing time, representing an average of 7.2

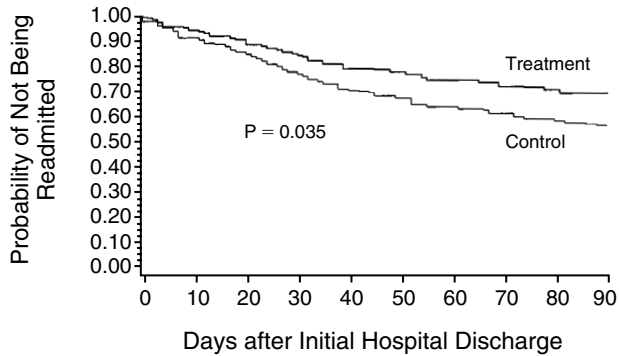


Figure 1. Kaplan-Meier Curves for the Probability of Not Being Readmitted to the Hospital during the 90-Day Period of Follow-up.

Data on patients who died without being readmitted were censored at the time of death.

hours per patient. Other costs for medical care, excluding those for readmissions, were similar between the two study groups. However, care givers spent 33 more minutes per patient per day attending to the patients in the treatment group than to those in the control group, for an estimated incremental cost of \$336 per patient. This extra time was anticipated and reflected increased involvement by care givers in the home. The costs of hospital readmissions were higher in the control group by an average of \$1,058 per patient (\$3,236 vs. \$2,178, $P=0.03$). As a result, the overall cost of care was higher in the control group by \$460, or an average of \$153 per patient per month.

DISCUSSION

The Agency for Health Care Policy and Research (AHCPR) recently published guidelines for the evaluation and care of patients with congestive heart failure.¹² These guidelines contain recommendations for patient and family counseling, dietary assessment, nursing and social-service interventions, support groups, and specific measures to improve compliance. These recommendations, though logical, are based principally on expert opinion, with few published data to verify their efficacy.¹² The present study provides strong support for the AHCPR guidelines by demonstrating that a multidisciplinary intervention can significantly reduce the rate of readmission, improve the quality of life, and decrease the overall cost of medical care. The benefit in terms of reducing hospital admissions and improving quality of life was at least as great as that reported with vasodilator therapy, including treatment with angiotensin-converting-enzyme inhibitors.¹³⁻¹⁶ Moreover, in contrast to treatment with vasodilators, the benefits of which are associated with incremental increases in cost,¹⁷ the current intervention reduced costs.

Several previous investigators have attempted to reduce readmissions in various patient populations,¹⁸⁻²⁹ but except for our pilot study,⁷ only one trial has specifically been addressed to patients with heart failure.²⁸

Although the results of these studies were generally favorable, the benefit was slight, perhaps reflecting the nature of the study populations and the interventions used. We focused specifically on elderly patients with heart failure, who are known to be at high risk for early readmission,³⁻⁵ and we developed a multidisciplinary intervention to address previously identified causes of rehospitalization.⁵ Although our findings are generally concordant with earlier reports,¹⁸⁻²⁹ we believe that our approach of targeting a high-risk population and using a more comprehensive intervention resulted in more favorable outcomes.

As expected, the principal effect of the intervention was in reducing the rate of readmission due to recurrent heart failure; this rate declined by 56.2 percent. However, in the treatment group there were also fewer readmissions for other causes. Although this difference was not statistically significant, it suggests that close follow-up may provide additional benefits beyond simply reducing the likelihood of exacerbations of heart failure.

This study has several limitations, the first of which concerns the generalizability of the results. A total of 1306 patients fulfilled the criteria for a diagnosis of congestive heart failure, but only 282 (21.6 percent) were randomized. The distinguishing characteristics of the randomized cohort included advanced age (median, 79 years), a high prevalence of hypertension (75.9 percent), moderate functional impairment, and relatively well preserved left ventricular systolic function. The applicability of our findings to other patients with heart failure requires further study.

A second limitation is that because of the multidisciplinary nature of the intervention, we are unable to say which elements were most important in reducing readmission rates and improving the quality of life. To do so is important from the perspective of cost, since the elimination of any unnecessary features could result in further cost savings. To clarify this issue, additional analyses were performed to assess compliance with medication, evaluate the review of medications, and determine the effects of the intervention on the patients' understanding of heart failure. Good compliance with medication, as assessed by pill counts 30 days after discharge and defined as having been accomplished when 80 percent of pills or more were tak-

Table 3. Independent Predictors of Readmission, According to the Cox Proportional-Hazards Model.

| VARIABLE | RISK RATIO* | 95% CONFIDENCE INTERVAL | P VALUE |
|-----------------------------------|-------------|-------------------------|---------|
| Blood urea nitrogen | 1.17 | 1.06-1.28 | 0.001 |
| Systolic blood pressure | 0.90 | 0.84-0.96 | 0.003 |
| Serum sodium | 0.94 | 0.89-0.98 | 0.007 |
| Diabetes mellitus | 1.60 | 1.05-2.44 | 0.03 |
| Assignment to the treatment group | 0.67 | 0.45-0.99 | 0.05 |

*Risk ratios were based on increments of 10 mg per deciliter (3.57 mmol per liter) for blood urea nitrogen, 10 mm Hg for systolic blood pressure, and 1 mmol per liter for serum sodium.

en correctly, was achieved in 82.5 percent of patients in the treatment group as compared with 64.9 percent in the control group ($P=0.02$). With regard to the number of medications and dosing frequency, the only difference between groups was that the maximal number of daily doses at discharge from the hospital was significantly lower in the treatment group (2.7 ± 1.0 , vs. 3.0 ± 0.9 in the control group; $P=0.01$), suggesting that the intervention had a slight effect in simplifying the medication regimen. Finally, on the basis of the results of an eight-item multiple-choice questionnaire, the patients in the treatment group had a better understanding of heart failure than those in the control group, both at the time of discharge and at the three-month follow-up ($P<0.001$ for both). These findings suggest that all components of the intervention were beneficial. Given the relatively low cost of the intervention (\$72 per patient per month), eliminating any of its components would be unlikely to lower the cost substantially.

A third limitation is the relatively short duration of the follow-up period. We selected a 90-day follow-up interval on the basis of previous studies showing that the period with the highest risk for readmission is the first 30 days after initial discharge and that readmission rates decline substantially after 3 months. Thus, to maximize cost effectiveness, the study was designed for high-risk patients during the high-risk period. Nonetheless, we followed all patients for one year. Readmission rates during the nine months after the discontinuation of the study intervention have been similar in the two groups (155 in the control group vs. 138 in the treatment group), but readmissions for heart failure have been less frequent in the treatment group (80 vs. 57, $P=0.08$). These data strongly suggest that the intervention did not simply postpone readmissions, but its beneficial effects also appeared to persist for up to one year. Thus, the long-term cost savings with the intervention may be even greater than our data indicate.

Although we believe that the reduced rate of readmission and the improved quality of life in our patients were direct consequences of the study intervention, two alternate hypotheses could explain our findings. First, the patients assigned to the control group may

Table 5. Costs of Care for the Study Patients.

| COMPONENT OF CARE | CONTROL GROUP | TREATMENT GROUP | DIFFERENCE |
|--------------------|----------------|-----------------|------------|
| | \$ per patient | | |
| Intervention | Not applicable | 216 | +216 |
| Care givers | 828 | 1,164 | +336 |
| Other medical care | 1,211 | 1,257 | +46 |
| Readmission | 3,236 | 2,178 | -1,058* |
| All | 5,275 | 4,815 | -460 |

* $P=0.03$ for the difference between groups.

have received substandard care. As we noted in the Methods section, the patients in the control group were treated by their private physicians, and no standard therapy was withheld. When we analyzed the medications taken at discharge, there were no differences between the groups in the use of digoxin, diuretics, angiotensin-converting-enzyme inhibitors, or other cardiovascular agents. Thus, differences in outcome cannot be attributed to differences in the medication regimen. With regard to the use of other services, dietary consultation was obtained by 49 percent of patients in the control group; 46 percent were seen in consultation by social-service personnel; and 39 percent had home care after discharge. These figures likely reflect current practice patterns for the use of these services in the United States.

Another alternative explanation for our findings is that the patients in the treatment group may have had better outcomes simply because of the increased attention and care they received. However, we consider it unlikely that the greater attention given to these patients accounted for the wide differences in outcomes; instead, the focused nature of the intervention and the fact that it had multiple components provide the most plausible explanations for our findings.

In summary, this study demonstrates that a nurse-directed, multidisciplinary treatment strategy can significantly reduce hospital readmissions and improve the quality of life for elderly patients with heart failure. Widespread use of this intervention in caring for the growing number of elderly patients hospitalized with heart failure could substantially reduce costs for health care.

Table 4. Changes in Quality-of-Life Scores as Determined from the Chronic Heart Failure Questionnaire.*

| SUBSCALE | CONTROL GROUP (N = 59) | | | TREATMENT GROUP (N = 67) | | | DIFFERENCE | P VALUE |
|-----------------------|------------------------|-----------|-----------|--------------------------|-----------|-----------|------------|---------|
| | BASE LINE | 90 DAYS | CHANGE | BASE LINE | 90 DAYS | CHANGE | | |
| | <i>mean ±SD</i> | | | | | | % | |
| All (total score) | 74.4±16.3 | 85.7±19.0 | 11.3±16.4 | 72.1±15.6 | 94.3±21.3 | 22.1±20.8 | +96 | 0.001 |
| Dyspnea | 8.1±7.7 | 11.9±10.0 | 3.8±5.4 | 9.0±7.9 | 15.8±12.8 | 6.8±7.9 | +79 | 0.01 |
| Fatigue | 14.1±5.6 | 16.8±5.5 | 2.7±6.1 | 12.9±5.3 | 18.3±6.3 | 5.4±5.5 | +100 | 0.01 |
| Emotional function | 33.3±8.1 | 35.2±8.4 | 1.9±5.2 | 31.9±8.5 | 37.4±7.8 | 5.6±7.1 | +195 | 0.001 |
| Environmental mastery | 18.9±4.8 | 21.7±4.6 | 2.9±5.0 | 18.3±5.8 | 22.7±4.9 | 4.4±5.3 | +52 | 0.10 |

*Higher scores on the questionnaire indicate less disability.

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