

An Intervention for VA Patients With Congestive Heart Failure

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Objective: To assess the effect of a telephone intervention to improve quality of life among patients with congestive heart failure (CHF).

Study Design: Prospective randomized study.

Methods: Single-site recruitment of 458 patients using Veterans Health Administration care into a randomized controlled trial with a 1-year pre-intervention data collection period and a 1-year intervention and follow-up period. To compensate for imbalanced study groups, propensity scores were included in adjusted models of quality of life, satisfaction with care, inpatient utilization, survival, and costs of care.

Results: Patients aged 45 to 95 years participated in the study; 22% were of Hispanic race/ethnicity, and 7% were African American. All but 5 were male, consistent with the older population among veterans. At baseline, 40% were in Goldman Specific Activity Scale class I, 42% were in class III, 6% were in class II or IV, and 12% were unclassified. Patients scored a mean (SD) of 14 (1.5) points below the norm on the physical component score. After the yearlong intervention, no differences in clinical outcomes were noted between the intervention group and the control group. The CHF-related costs were higher for the intervention group, as were overall costs that included the cost of the intervention. Intervention group patients reported better compliance with weight monitoring and exercise recommendations.

Conclusions: A risk-stratified intervention for patients with CHF resulted in potential behavioral improvements but no survival benefit. A high-cost high-intensity intervention may be required to improve survival for patients with CHF. Inclusion of the costs of interventions is recommended for future researchers.

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For author information and disclosures, see end of text.

Several randomized trials of telephone interventions for patients with congestive heart failure (CHF) have shown improvement in patient outcomes. In a study of 49 patients by Spaeder et al,¹ equivalent β -blocker titration doses were achieved using telemedicine to monitor dose titration compared with in-clinic monitoring, but telemonitoring resulted in a shorter time to the final dosage. Jerant et al² found reduced readmission rates associated with telenursing strategies for postdischarge care of 37 patients with CHF. Using an intensive telephone disease management intervention among more than 1000 patients, Galbreath and colleagues³ achieved a survival benefit averaging 76 days. Hopp and colleagues⁴ studied a small sample of Veterans Health Administration (VA) patients with CHF and noted greater improvements in self-reported mental health status (health-related quality of life and the mental health component) for patients receiving telemedicine (video monitoring and feedback) versus patients in usual care. Approaches vary with respect to video monitoring versus telephone versus delayed report, as well as the outcomes assessed, but findings support the use of more frequent symptom monitoring to improve care. Less persuasive evidence of improved outcomes is reported, and systematic review teams such as Maric and colleagues⁵ note the ongoing need for large-scale randomized trials. Replicability of results showing survival benefit should be verified before implementation of interventions for these resource-intensive patients.

In a randomized controlled trial among 458 VA patients with CHF, we tested a telemedicine intervention designed to improve patients' health-related quality of life and clinical outcomes with minimal effect on costs of care among VA patients with CHF. We hypothesized that, compared with control group patients receiving usual care, patients receiving the intervention would have (1) improved physical and mental health-related quality of life and (2) equivalent costs of care. As secondary objectives, we examined the effects of the intervention on survival over a 1-year period and on compliance and satisfaction with care.

METHODS

Sample

Patients receiving care at a large southwestern medical center in the VA were recruited into a trial of an intervention to improve outcomes and quality of life among patients with CHF. Approval of the study was granted by the institutional review board before study initiation.

In this article
Take-Away Points / p159
www.ajmc.com
Full text and PDF
Web exclusive
eAppendix

Subjects participated in the informed consent process and granted consent in writing.

Eligibility criteria included the following: age at least 18 years, diagnosis of CHF (*International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD-9-CM] codes 425 and 428), receipt of inpatient care or urgent care or more than 12 outpatient visits in the past 12 months, and speaker of English or Spanish.

Of 539 patients identified, 81 (15%) were ineligible. Reasons for ineligibility included the following: (1) end-stage renal disease or congestive dialysis, (2) prior heart transplant, (3) end-stage or terminal illness in addition to CHF (such as metastatic malignant neoplasm or AIDS) with anticipated life expectancy less than 6 months, (4) residence in a nursing home, (5) participation in another research or care management program, (6) refusal to participate in the study, (7) relocation out of the area, and (8) severe dementia.

Study Design

The study used a prospective randomized controlled design, with a 1-year intervention and data collection period. Retrospectively, 1-year preintervention data were collected to provide baseline assessments. In June 2005, the intervention team began contacting identified patients with CHF for enrollment in a 1-year home-based telephone disease management CHF program. Recruited patients were assigned to treatment or control status based on the last digit of their social security number (odd vs even). Enrollment occurred over a 6-month period from mid-June through December 1, 2005. All veterans enrolled in this telephone disease management program continued to receive comprehensive CHF care from the VA. Registered nurses conducted a telephone survey at intake, with reassessments at 6 and 12 months querying participants' knowledge, behavior, and health status. The study was registered at clinicaltrials.gov (identifier NCT00141856). A CONSORT (Consolidated Standards of Reporting Trials) flowchart in the [Figure](#) shows the sample development.

Intervention

When patients agreed to enroll, the intervention team (McKesson Corporation) created a participant-specific self-management plan using the primary care physician's therapeutic plan, the intensity of which varied per a standardized risk stratification algorithm. Risk stratification was determined using a combination of review of the medical record, patient admission history, and self-report at baseline. Factors included the Goldman Specific Activity Scale,⁶⁻⁸ self-man-

Take-Away Points

In future investigations, the cost of interventions for congestive heart failure (CHF) should be included in cost analyses to provide clinical and policy decision makers with a clear picture of the economic implications of novel interventions.

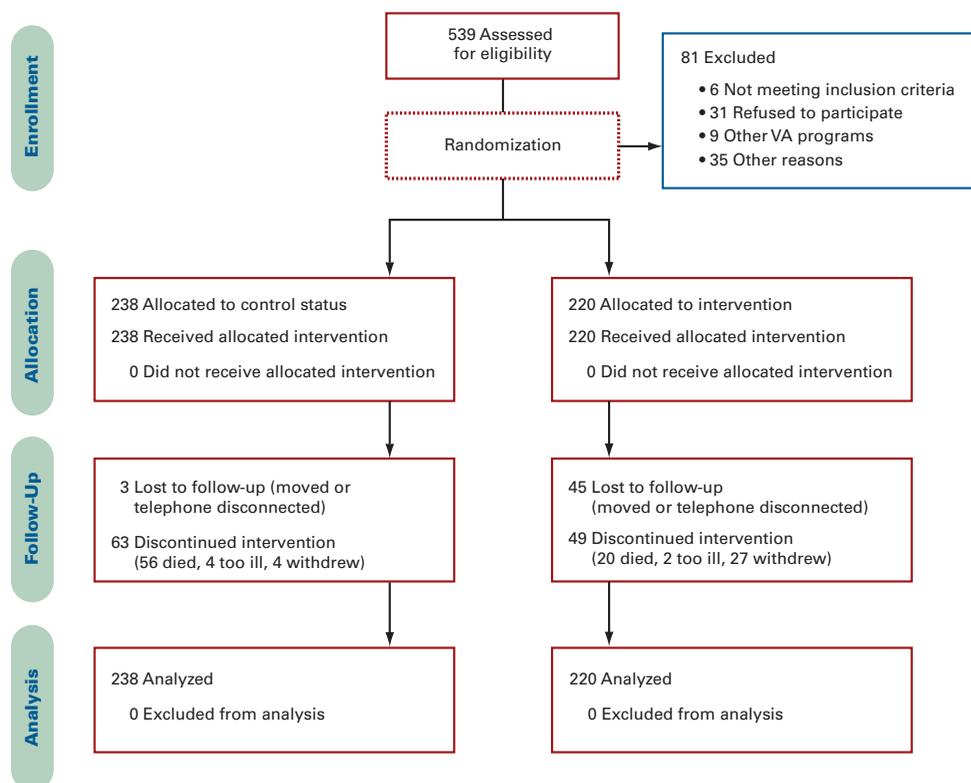
- This study showed evidence of positive effects of an intervention of variable intensity for CHF on healthcare utilization, self-care behaviors, and possibly quality of life.
- This study found no survival benefits of the intervention; future research should attempt to determine what components and level of intensity are required to affect survival.
- Healthcare systems may need to balance intervention cost increases against multiple benefits to patients.

agement practices,⁹ medical history and management,^{6,7,9-15} and psychosocial factors.^{7,9} The copyrighted algorithm used Boolean logic and sorted patients into 3 risk categories that determined the frequency of scheduled telephone interactions over the course of the year (low risk [2 calls], medium risk [7 calls], and high risk [16 calls]). Full details are available from the developer.

During the scheduled telephone interactions, disease management nurse interventions included education and coaching for behavior change based on guidelines established by the American Heart Association¹⁶ and using motivational interviewing principles.¹⁷ Interventions occurred more frequently in the first 6 months of the program, and high-risk participants were called on average every 3 to 4 weeks, medium-risk participants every 8 weeks, and low-risk participants every 6 months. The mean intervention length was 30 to 40 minutes and focused on the participant-specific self-management plan derived from the participant admission history and based on the program focus. The program focus was participant education and behavior change for fluid weight management, medication adherence, diet, early treatment for escalating symptoms, discussion of recent laboratory values, and vital signs monitoring.

The intervention included access to a nurse advice line for symptoms and counseling 24 hours a day 7 days per week, medication compliance reminders, vaccination reminders, and printed literature, including action plans, workbooks, and postassessment letters, in addition to the scheduled nurse education and motivational interviewing sessions. The participant's physician was provided with faxed alerts about signs and symptoms of decompensation, as well as notification of gaps between participant-reported practice and guideline recommendations. In addition, communication to physicians occurred through the VA electronic medical record system regularly and was customary after each scheduled call, providing information on the patient's condition. Physicians were encouraged to communicate to the disease management registered nurses through the electronic medical record system, providing their recommendations for further counseling topics or clarification of subject-reported information.

■ **Figure.** CONSORT Flowchart for CHF Intervention Trial



CHF indicates congestive heart failure; CONSORT, Consolidated Standards of Reporting Trials; VA, Veterans Health Administration.

During the study, intervention nurses averaged 157 patient telephone interventions per month for the first 12 months and 121 interventions per month overall for 19 months. Altogether, 89% of interventions were completed within the first 13 months. Fewer than 75 interventions per month were completed after the first 13 months.

Measures

Sources of data included patient self-report in the structured interviews, a VA resource allocation center for cost estimates, a medical record review of the patient's electronic medical record, and administrative extracts of the medical record. Extracts from the VA's all-electronic medical record are transmitted nightly to a central data repository according to a nationally standardized protocol for inclusion in administrative databases, which may be accessed for research purposes. The VA databases provided demographics, vital statistics, VA priority status diagnoses, procedures and dates of care for inpatient and outpatient health services, and medication prescriptions and selected laboratory results.

Congestive heart failure was denoted by ICD-9-CM code 425 or 428. Comorbidity was measured by indicators for diagnosis of chronic obstructive pulmonary disease (COPD) (codes 490-496, 500-505, and 506.4), hypertension (codes

401-405), and diabetes (code 250). In addition, we calculated the modified Charlson-Deyo comorbidity index, a weighted score assessing 18 conditions (CHF, myocardial infarction, peripheral vascular disease, stroke, chronic lung disease, peptic ulcerative disease, rheumatologic disease, dementia, hemiplegia, diabetes, diabetes with complications, mild liver disease, moderate-to-severe liver disease, renal disease, cancer, metastatic cancer, AIDS, and human immunodeficiency virus without AIDS).^{18,19} These measures were assessed for both years (preintervention and postintervention).

Demographics from the medical record extracts included age at baseline, race/ethnicity (white, African American, or other or missing), sex, and marital status (married vs other status). Priority status for care in the VA is assigned by the VA during enrollment in the healthcare system based on a veteran's military service and service-related medical conditions. Values range from 1 to 8. Priority 1 veterans have a service-connected condition that is 50% to 100% disabling. Priority status was extracted from enrollment files and was recoded as high-priority versus any lower-priority status. High-priority veterans did not have copayments for care or medications, whereas lower-priority veterans had copayments.

Additional data were collected by medical review, including baseline medications, lipid levels, blood pressure, moder-

ate-to-severe ejection fraction, and vaccination status. Lipids included total cholesterol, high-density lipoprotein, low-density lipoprotein, and triglycerides and were averaged across all baseline-year values. Medication use assessed prescriptions each year for angiotensin-converting enzyme inhibitors, anti-hypertensives, β -blockers, diuretics, and cardiac glycosides. Blood pressure was the highest outpatient value recorded in the baseline year. High blood pressure was defined as exceeding 140 mm Hg systolic or 90 mm Hg diastolic for patients without diabetes and as exceeding 130 mm Hg systolic or 80 mm Hg diastolic for patients with diabetes. Moderate-to-severe ejection fraction denoted an indication of moderate or severe systolic dysfunction recorded from any of the following test results noted in the medical record: cardiac catheterization, transthoracic echocardiogram, multiple gated acquisition scan, or persantine thallium stress test.

Outcomes were inpatient use per year, including admissions (total and CHF-related, where CHF was the primary diagnosis) and 30-day readmissions. Estimated costs of care were provided by the VA cost allocation resource center and were tailored to each patient's date of enrollment. The following 4 measures were analyzed: prescription medication costs, outpatient care costs, total costs attributable to CHF, and total costs of care. To the total costs of care for intervention patients, we added the mean per-patient cost of the intervention. Intervention costs of care were provided by the intervention developer. Costs of the intervention included staff time, the largest component, plus profit margin and office overhead. We calculated survival in the study period using dates of birth and death. All measures except survival captured the 12 months before enrollment (baseline) and the 12 months initiated by enrollment (year 1). Difference scores reflected year 1 minus baseline values. For the regression models, year 1 cost measures were logged, as these values were highly skewed and did not meet linear regression assumptions.

Patient satisfaction was assessed by 5 questions querying the quality of the information, reassurance, and care provided by the healthcare team, assessed at 12 months (no preintervention assessment). The 5 satisfaction-with-care items formed a single factor when subjected to factor analysis with Cronbach α of 0.91. This summary score of satisfaction was analyzed. An additional 4 questions (check weight daily, follow diet, take medications, and exercise regularly as directed) assessed compliance with recommendations (eAppendix available at www.ajmc.com). The 6-point response sets ranged from "always or daily" to "never," which were dichotomized to always or daily versus any other response.

Health-related quality of life was assessed by the 8-Item Short Form Health Survey, scored as the physical component score and the mental component score. The component scores

are normalized at 50 with an SD of 10, such that group means less than 50 identify patients with health deficits compared with normal populations. A difference of 5 points is considered clinically significant.^{20,21}

Statistical Analysis

All analyses were conducted in an intent-to-treat fashion. A criterion α level of .05 was used.

Baseline Comparison. Intervention and control group patients were compared using χ^2 test or t test as appropriate to the measurement level of the variables.

Difference in Difference. Difference-in-difference calculations compared outcomes of the program period versus the baseline period between the intervention and control groups. The first difference was between the program period and the baseline period for each group. That is, among intervention group patients, we calculated the program period mean or percentage less their baseline period mean or percentage, and among control group patients, we calculated their program period mean or percentage less their baseline period mean or percentage. The second difference was between the intervention and control groups (intervention group first difference less control group first difference). t Test was used to compare intervention changes with control changes.

Adjusted Regression Models. After baseline differences were detected between the intervention and control groups, propensity scores were estimated using logistic regression predicting intervention status (intervention vs control).²² The regression model included 50 baseline measures; the estimated probability of treatment was captured as the propensity score. Covariate balance was verified in post hoc models assessing differences by intervention status and the interaction of intervention by propensity score quintile; no significant differences were found between treated and untreated subjects except cardiac glycoside use, for which an interaction between treatment status and quintile persisted ($P = .02$). Regression analyses then assessed differences in year 1 outcomes by treatment group assignment, controlling for propensity score.^{23,24} Logistic regression analysis modeled dichotomous outcomes. For the count variables (admissions, CHF-related admissions, and 30-day readmissions), generalized linear modeling with a log link to model a negative binomial distribution was chosen. A Cox proportional hazards model estimated the hazard rate ratio of treatment associated with survival. For all other outcomes variables, ordinary linear regression was applied. Analyses were completed using SAS (version 9.2, SAS Institute, Cary, NC). Outcomes modeled included admissions, CHF-related admissions, 30-day readmissions, physical component scores, mental component scores, survival, outpatient costs, medication costs, CHF-related costs, total costs over 12 months, patient satisfaction scores, and di-

chotomized responses (always or daily vs any other response) to compliance with treatment recommendation items.

RESULTS

The mean (SD) age was 70 (11) years (age range, 45-95 years) among 220 patients in the intervention group and 238 patients in the control group. Most patients (99%) were male. Their races/ethnicities were white (50%), Hispanic (22%), or African American (7%), with 22% of other or missing race/ethnicity. One year after study initiation, 7% of patients had died, including 6% of control group patients and 8% of intervention group patients.

At baseline 40% were in Goldman Specific Activity Scale class I, nearly 5% were in class II, 42% were in class III, 3% were in class IV, and nearly 12% were missing. The CHF-related risk stratification for the patients randomized to intervention care resulted in classification of 33% as high risk, 54% as moderate risk, and 13% as low or indeterminate risk. These classifications determined intervention intensity.

The CHF-related costs (and total costs) for the intervention year varied by risk level. High-risk patients had significantly higher mean (SD) costs (\$8845 [\$17,989] CHF-related cost and \$31,732 [\$35,131] total cost) than moderate-risk patients (\$2606 [\$3445] CHF-related cost and \$14,320 [\$18,312] total cost). The mean (SD) costs of moderate-risk patients were not significantly different from those of low-risk patients (\$2344 [\$1986] CHF-related cost and \$4621 [\$3294] total cost).

Baseline Comparison

To verify randomization to intervention and control status, demographic and baseline variables were compared as summarized in **Table 1**. Statistically significant differences were noted for race/ethnicity and for comorbid COPD.

Difference in Difference

The difference-in-difference results showed higher total costs of approximately \$6165 (95% confidence interval [CI], \$805-\$11,524; $P < .02$) for intervention group patients relative to control group patients (**Table 2**). A trend toward significance ($P = .06$) was noted for the physical component score, reflecting score changes from 36.3 to 37.4 for control group patients versus from 35.4 to 39.0 for intervention group patients among 240 patients responding to the final survey. No significant differences were noted for the mental component score, admissions, CHF-related admissions, 30-day readmissions, medication costs, or cost subcategories.

Multivariable Regression

Because of baseline differences already noted, the simi-

larity of the intervention and control groups at baseline was deemed insufficient to ensure that the difference-in-difference analyses would provide unbiased comparisons between the intervention and control groups. Therefore, the data were reanalyzed in multivariable models, adjusting for propensity to be assigned to intervention versus control status. The multiple regression analyses supported the previous findings of higher costs among intervention group patients. The CHF-related costs were higher among intervention group patients ($P < .01$) (**Table 3**). Total costs were higher among intervention group patients ($P < .01$). Both CHF-related and total costs included the cost of the intervention in the outcomes for intervention group patients. After the 1-year intervention period, there were no significant differences in satisfaction with care (averaging 22.4 for both groups on a scale of 0-25); however, intervention group patients reported better compliance with 2 of 4 self-care recommendations, check weight daily (odds ratio [OR], 1.94; 95% CI, 1.06-3.55; $P = .03$) and exercise regularly as directed (OR, 1.94; 95% CI, 1.08-3.49; $P = .03$). No differences in health-related quality of life, inpatient utilization measures, or survival were detected.

DISCUSSION

Our telephone-based intervention for patients with CHF tailored the intensity of the intervention to the risk level of the patients, a potentially cost-saving approach, as resources are deployed according to patient need. Interventions that are intended to improve health-related quality of life tend to increase utilization and costs of care; therefore, a cost-neutral intervention was the goal. Our study improved on prior approaches by including the cost of the intervention in the evaluation of the intervention; however, the hypothesis of a cost-neutral intervention was not supported. When including the mean cost of the intervention with the healthcare costs of intervention group patients, the total cost of care was higher for intervention status. The cost of the intervention was modest (mean, \$635 per intervention group patient), but additional associated costs from increased healthcare utilization were noted among intervention group patients relative to usual care. The intervention may have prompted needed medical service utilization by facilitating access to care, resulting in higher costs of care, including outpatient and CHF-related care costs. Our intervention seems to have modestly improved weight monitoring and exercise behavior for these ill patients. Hypothesized improvements in physical and mental health-related quality of life were not found, although power to detect these changes was low; a marginal increase in physical health-related quality of life may have been achieved.

VA Patients With Congestive Heart Failure

Table 1. Baseline Comparison Between the Intervention and Control Groups

Variable	Intervention Group (n = 220)	Control Group (n = 238)	P
Age, mean (SD), y	70.5 (10.7)	69.5 (10.8)	.35
Age >75 y, %	39.6	32.4	.11
Race/ethnicity, %			<.001
African American	5.9	8.8	
Hispanic	25.0	19.3	
White	57.3	41.2	
Other or missing	11.8	30.7	
Copayment required, %	65.3	63.3	.18
Tobacco use, %	19.8	17.2	.48
Goldman Specific Activity Scale class, %			.81
I	41.4	37.8	
II	5.0	4.2	
III	39.1	44.1	
IV	2.3	2.9	
Missing	12.3	10.9	
CHF, %	39.6	29.4	.02
Hypertension, %	81.4	81.5	.97
Diabetes, %	53.2	55.5	.62
Charlson-Deyo comorbidity index, modified to exclude CHF, mean (SD)	2.2 (1.7)	2.1 (1.7)	.65
Ejection fraction indicates moderate-to-severe impairment, % (n = 337)	35.4	37.2	.73
Oxygen dependence, %	4.5	3.8	.68
Influenza immunization within past 12 mo, %	25.5	18.5	.07
Pneumococcal immunization ever, %	13.6	13.9	.94
Cholesterol level, mean (SD), mg/dL			
High-density lipoprotein	41.3 (11.9)	40.8 (11.0)	.69
Low-density lipoprotein	82.8 (27.8)	80.2 (27.1)	.36
Triglycerides level, mean (SD), mg/dL	164.8 (124.7)	151.6 (98.3)	.26
High blood pressure ≥140/90 mm Hg or ≥130/80 mm Hg for patients with diabetes, %	83.2	84.5	.71
Blood pressure, mean (SD), mm Hg			
Diastolic	68.1 (8.0)	69.0 (8.7)	.24
Systolic	129.8 (14.3)	130.8 (14.6)	.45
Physical component score, mean (SD)	35.4 (10.3)	36.3 (11.0)	.39
Mental component score, mean (SD)	46.8 (11.2)	46.4 (11.5)	.66
Angiotensin-converting enzyme inhibitor use, %	75.5	72.3	.44
Other antihypertensive use, %	12.7	11.3	.65
β-Blocker use, %	79.1	82.4	.38
Cardiac glycoside use, %	34.5	31.5	.49
Diuretic use, %	85.9	81.1	.17
VA inpatient utilization in the 12 mo before randomization, mean (SD)			
Admissions	0.94 (1.49)	0.92 (1.33)	.93
CHF-related admissions	0.17 (0.59)	0.14 (0.37)	.52
30-Day readmissions	0.25 (0.69)	0.17 (0.51)	.13
VA costs in the 12 mo before randomization, mean (SD), \$			
Medication costs	2814 (3174)	3035 (3107)	.45
Outpatient costs	8212 (11,777)	8897 (11,519)	.53
CHF-related costs, including cost of the intervention	6203 (16,345)	3967 (8943)	.07
Total costs, including cost of the intervention	21,456 (27,727)	22,658 (26,756)	.64

CHF indicates congestive heart failure; VA, Veterans Health Administration.

SI conversion factors: To convert cholesterol level to millimoles per liter, multiply by 0.0259; to convert triglycerides level, multiply by 0.0113.

■ **Table 2.** Difference-in-Difference Results Among the Cohort^a

Outcome	Difference in Difference (95% CI)	P
Physical component score (n = 240)	2.51 (−0.13 to 5.15)	.06
Mental component score (n = 240)	−1.57 (−4.31 to 1.16)	.26
Admissions	0.14 (−0.16 to 0.43)	.37
CHF-related admissions	−0.02 (−0.13 to 0.09)	.72
30-Day readmissions	−0.07 (−0.22 to 0.08)	.38
Medication costs, \$	52 (−393.50 to 498)	.82
Outpatient costs, \$	1693 (−201 to 3587)	.08
CHF-related costs, \$	−417 (−3189 to 2764)	.89
Total costs, including cost of the intervention, \$	6165 (805 to 11,524)	<.02

CHF indicates congestive heart failure; CI, confidence interval.

^aPositive difference in difference means that the intervention group had a higher value.

■ **Table 3.** Multivariable Regression Results

Model	Dependent Variable	Value (95% CI)	P
1	Physical component score	2.49 (−0.40 to 5.38)	.09
2	Mental component score	−1.29 (−4.49 to 1.90)	.43
3	Admissions	0.14 (−0.24 to 0.52)	.47
4	CHF-related admissions	−0.05 (−0.80 to 0.70)	.90
5	30-Day readmissions	0.09 (−0.58 to 0.76)	.80
6	Medication costs, logged	0.04 (−0.26 to 0.34)	.80
7	Outpatient costs, logged	0.26 (0.02 to 0.50)	.03
8	CHF-related costs, including cost of the intervention, logged	4.08 (3.41 to 4.75)	<.01
9	Total costs, including cost of the intervention, logged	0.32 (0.09 to 0.55)	<.01
10	Satisfaction with care at 12 mo (n = 240)	0.47 (−0.67 to 1.62)	.42
11	Survival	1.38 (0.67 to 2.84)	.39
12	Check weight daily at 12 mo (n = 240)	1.94 (1.06 to 3.55)	.03
13	Follow recommended diet at 12 mo (n = 240)	1.29 (0.72 to 2.29)	.39
14	Take medications as directed at 12 mo (n = 240)	0.59 (0.20 to 1.73)	.34
15	Exercise regularly as directed at 12 mo (n = 240)	1.94 (1.08 to 3.49)	.03

CHF indicates congestive heart failure; CI, confidence interval.

We were unable to replicate the survival benefit reported by Galbreath and colleagues³ in a study in south Texas among 1069 subjects. Our study had a shorter follow-up period, which may explain this result, or the results by Galbreath et al may have been atypical. We await replication of this result.

Limitations of the study include an unusual randomization approach, which we addressed through propensity score methods; the final digit of social security numbers is not necessarily randomly assigned. Propensity scores have been repeatedly shown to adjust for baseline differences among treatment groups and are frequently used to summarize covariates when analytic power must be conserved.²⁴ In addition, intervention process measures and patient-level details on numbers of calls

and alerts were unavailable for this study. Results of this study may not be generalizable to non-VA patient populations; the highly comorbid VA patient population differs from that encountered in other healthcare systems and may partially explain the limited effects achieved. As another limitation, patients' use of Medicare benefits was unavailable for this study; therefore, costs associated with Medicare-reimbursed healthcare use were not included. The VA patients are free to use Medicare benefits, which would tend to reduce VA utilization and VA costs; this was unlikely to affect intervention and control group patients differentially. The heterogeneous patient population may have merited a stratified randomization, as the heterogeneity reduced analytic power, as did high attri-

tion rates. Compliance with care recommendations may warrant investigation as a primary outcome in future research.

All patients reported high satisfaction with care. Although the intervention was generally well received, patients in the intervention group did not report significantly greater satisfaction with care. As interactive modes advance in the healthcare setting, more innovative approaches may prove especially appealing to patients (eg, interventions with a videophone option so patients can see their nursing providers during conversations). On the other hand, a cost-effective intervention that improves self-care, while simultaneously increasing patient satisfaction above already high levels, may not be achievable. Our intervention showed a trend toward improved physical well-being with higher total costs of care. Coupled with improved self-care, this may represent an optimal solution to the difficult multifaceted problem of how to improve care and outcomes for severely ill patients within a resource-scarce healthcare environment.

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