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What Works In Chronic Care Management: The Case Of Heart Failure

Multidisciplinary provider teams with in-person communication lead to fewer hospital readmissions for people with heart failure.

by Julie Sochalski, Tiny Jaarsma, Harlan M. Krumholz, Ann Laramee, John J.V. McMurray, Mary D. Naylor, Michael W. Rich, Barbara Riegel, and Simon Stewart

ABSTRACT: The evidence base of what works in chronic care management programs is underdeveloped. To fill the gap, we pooled and reanalyzed data from ten randomized clinical trials of heart failure care management programs to discern how program delivery methods contribute to patient outcomes. We found that patients enrolled in programs using multidisciplinary teams and in programs using in-person communication had significantly fewer hospital readmissions and readmission days than routine care patients had. Our study offers policymakers and health plan administrators important guideposts for developing an evidence base on which to build effective policy and programmatic initiatives for chronic care management. [*Health Affairs* 28, no. 1 (2009): 179–189; 10.1377/hlthaff.28.1.179]

IN JANUARY 2008 THE CENTERS FOR Medicare and Medicaid Services (CMS) announced the completion of Phase I of Medicare Health Support (MHS), a voluntary chronic care management program for Medicare beneficiaries with congestive heart failure (CHF), diabetes, or chronic obstructive pulmonary disease (COPD). Although an evaluation of the program continues at this writing, within its first six months the program had not met its statutorily required quality and financial targets.¹ That same month, a four-year evaluation of Medicare's Coordinated Care Demonstration (MCCD) reported a number of quality improvements, although no overall reduction in spending among its fifteen

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structurally and geographically diverse coordinated care programs that enrolled a broad range of chronically ill beneficiaries.² Although the chronic care management programs implemented under these two initiatives embodied many features associated with quality of care and improved outcomes, their inability to meet both quality and program spending targets raises questions about how, or even if, these targets can be met.³ The answers to these questions are critical to the CMS, which has invested considerable resources during the past decade in testing new models of care for the chronically ill and developing payment incentives to encourage their adoption.⁴

Medicare is not alone in this dilemma. Many private health plans and public payers have embraced similar chronic care management programs and have likewise experienced the full range of encouraging and disappointing results.⁵ Notwithstanding the large body of literature on the implementation and evaluation of such programs, a robust and actionable evidence base of what works in chronic care management remains remarkably underdeveloped. Its absence hampers the development and dissemination of effective programs to better manage the care and costs of some of the most costly patients: those with chronic illnesses.

In this paper we describe our effort to contribute to this evidence base through an explication of what works in chronic care management for heart failure patients. This effort involved pooling and reanalyzing data from ten randomized clinical trials that had tested the effects of chronic care management programs for heart failure patients discharged from a recent hospital stay (Exhibit 1).⁶ These ten clinical trials were conducted by the paper's coauthors, a group of internationally recognized heart failure experts who formed a partnership to undertake a systematic assessment of what works in chronic care management for heart failure patients. The programs used in these ten trials were similar in content but differed on delivery methods. Specifically, the trials varied on delivery personnel—six of the ten used a single heart failure expert, and four used a multidisciplinary team—and on communication method—three trials used telephonic communication, and seven used a combination of in-person and telephonic communication, which for simplicity and clarity we refer to as “in-person” communication. Pooling and reanalyzing the data from these ten trials allowed us to directly assess the influence of different combinations of these delivery methods on program outcomes. We exploited these data to discern if the effectiveness of chronic care management programs is materially influenced by delivery methods used, and we discuss the implications of our findings for public- and private-sector payers interested in the wider application of these programs.

Study Data And Methods

In this study we asked: Do the delivery methods used in care management programs for heart failure contribute to differences in hospital readmissions?

■ **Data sources.** The ten trials that formed the basis of this study were con-

EXHIBIT 1
Data Set, Study Of The Effects Of Chronic Care Management Programs For Heart Failure Patients Discharged From A Recent Hospital Stay

Data set and study years (N = 2,028)	Number of patients		Program effect on all-cause readmissions in original study	Percent of study sample
	Program (n = 961)	Routine care (n = 1,067)		
Stewart (1997–98) (n = 200)	100	100	42% lower in program group**	9.9
Stewart (1995–97) (n = 97)	49	48	42% lower in program group**	4.8
Jaarsma (1994–97) (n = 179)	84	95	No difference between groups	8.8
Blue (1997–98) (n = 165)	84	81	27% lower in program group**	8.1
Krumholz (1997–98) (n = 88)	44	44	39% lower in program group*	4.3
Laramée (1999–2001) (n = 286)	141	145	No difference between groups	14.1
Naylor (1997–2001) (n = 239)	118	121	34% lower in program group**	11.8
Rich (1990–94) (n = 282)	142	140	44% lower in program group**	13.9
Riegel (1998–99) (n = 358)	130	228	28% lower in program group**	17.7
Riegel (2002–04) (n = 134)	69	65	No difference between groups	6.6

SOURCES: See Note 6 in text for full citations.

NOTES: Program effect obtained from publications on each study. Percentage of study sample based on authors' calculations.

* $p < 0.10$ ** $p < 0.05$

ducted from 1990 through 2004, in Australia (2), the Netherlands (1), the United Kingdom (1), and the United States (6). In total they comprised 2,028 cases—961 program patients and 1,067 routine care patients (Exhibit 1). The ten trials contributed from 4.3 percent to 17.7 percent of the patients in the study sample.

The database for this study comprised pooled individual-level data from the ten trials. We identified the key patient-level variables needed to conduct the analyses: sociodemographic and clinical characteristics and measures of hospital use. We reviewed the contents of each data set and extracted the required variables from each. We examined the level of measurement used for each selected variable, and, where needed, we created a common level of measurement across data sets. We merged the extracted variables to create the final pooled study data set.

■ **Outcome measures.** We selected two outcome measures—hospital readmissions and readmission days—that were focal outcomes in each of the ten trials and ones that are commonly found in the evaluations of chronic care management programs. We used all-cause rather than heart failure readmissions because of data

availability across the ten trials. The number of hospital readmissions and readmission days varied substantially across the ten trials for several reasons. First, the follow-up period over which outcomes were tracked varied from three to twelve months among these ten trials. Second, these trials spanned a fourteen-year period during which hospital admissions and lengths-of-stay declined. Finally, hospital admission practice patterns differ notably between the United States and the other countries. We adjusted for the influence of these factors by calculating hospital readmissions and readmission days per month for each person, and we used log-transformed versions of these measures in our analyses.⁷

■ **Delivery method measures.** We adapted the Taxonomy of Disease Management, a framework developed by the American Heart Association's (AHA's) Writing Group delineating features of disease management programs, to construct measures of the delivery methods used in this study.⁸ Each trial was rated on seven program features derived from the taxonomy. Ratings on three features that embodied the content of the programs—education and counseling, environment, and program recipient—did not differ across the programs. Ratings on two features comprising other program elements—intensity/complexity of follow-up and medication management—did not vary significantly across the trials. Two program features capturing the delivery method—personnel and method of communication—differed among the trials and were the focus of our evaluation.

Delivery personnel. Delivery personnel was identified as a key domain in the AHA's disease management taxonomy, although the Writing Group acknowledged that substantive evidence on the personnel configurations that produced optimal outcomes was still lacking. Two recent meta-analyses of chronic care management in heart failure found positive outcomes associated with multidisciplinary programs.⁹ The ten trials constituting this study used two different personnel configurations that were commonly found among chronic care management programs: (1) a single heart failure expert, here a registered nurse (RN) with clinical expertise in cardiology and heart failure (six trials), and (2) multidisciplinary teams spanning a range of disciplines (four trials). We assigned to each program patient an indicator of the personnel configuration used in his or her program.

Method of communication. The method for communicating program content was also identified as a key domain by the AHA Writing Group. Common forms of communication in care management programs include telephonic and in-person (face-to-face) communication. Several recent meta-analyses evaluating the effectiveness of telephonic communication in heart failure care management programs found evidence of its positive effect on a range of outcomes (for example, mortality, satisfaction, and readmissions).¹⁰ In addition, the evaluation of the CMS's MCCD initiative found that programs with greater in-person contacts were more effective than others on a range of quality outcomes.¹¹ Three of the trials in this study used telephonic communication contact, and seven used in-person commu-

nication. We assigned to each program patient in the study an indicator of the method of communication used in his or her program.

Both factors. We sought to evaluate the relative contributions of these two factors to program outcomes by categorizing the ten trials into three groups that represented their combined ratings on each of the two delivery methods: three trials using a single heart failure expert and telephonic communication, three trials using a single heart failure expert and in-person communication, and four trials using a multidisciplinary team and in-person communication. We then assessed the effect of these combinations on readmissions. None of the ten trials used multidisciplinary teams and telephonic communication.

■ **Data analysis.** Regression analyses using linear mixed models to capture the fixed effects of delivery method elements and beneficiary characteristics and the random effects of the ten parent trials were employed to assess the effects of delivery personnel and method of communication on hospital readmission and readmission days. Two parallel sets of analytic models were run with hospital readmissions and readmission days as the dependent variables. Model covariates included patient characteristics associated with severity of illness and consequently hospital use—age, sex, history of hypertension, and prior heart attack—and the three delivery method measures. The models incorporated a random effect for the parent trial.¹²

Study Results

Program and routine care patients did not differ on any sociodemographic or clinical characteristics. Our study sample was largely an elderly cohort; roughly half the study sample was male; and one-third were from racial/ethnic minority groups (Exhibit 2). Two-thirds had comorbid hypertension, and nearly half had experienced a heart attack before enrolling in the study. Many patients were in an advanced state of disease: 46 percent were classified as New York Heart Association Class IV. Fewer program patients (42 percent) than routine care patients (49 percent) were readmitted to the hospital during the follow-up period. Program patients had 25 percent fewer all-cause readmissions and 30 percent fewer all-cause readmission days. The unadjusted mean number of readmissions and days per month were significantly lower for program than for routine care patients (results not shown).

■ **Impact of delivery personnel.** The results from the regression analysis showed that delivery personnel influenced hospital readmissions and readmission days, after patients' sociodemographic and clinical characteristics were controlled for (Exhibit 3). Patients enrolled in chronic care management programs using a multidisciplinary team approach had significantly fewer hospital readmissions and readmission days than routine care patients—a 2.9 percent reduction in readmissions per month and a 6.4 percent reduction in readmission days per month over routine care. The same was not true for patients whose programs used a single heart failure expert—the reductions were not significantly different from the readmission

EXHIBIT 2
Baseline Characteristics Of The Study Sample, Effects Of Chronic Care Management Programs For Heart Failure Patients Discharged From A Recent Hospital Stay

Characteristic	Program (n = 961)	Routine care (n = 1,067)	Total (N = 2,028)
Mean age, years (SD)	74.2 (10.0)	74.1 (10.2)	74.1 (10.1)
Percent male	49.1%	48.9%	49.0%
Race			
White	65.9%	59.5%	62.5%
Black	13.5	13.3	13.4
Hispanic	10.9	11.5	11.2
New York Heart Association class ^a			
I	3.6%	3.8%	3.7%
II	20.2	16.9	18.4
III	30.0	32.7	31.4
IV	46.2	46.7	46.4
History of hypertension	63.6%	65.3%	64.5%
Prior heart attack	46.8	46.8	46.8
Total no. of patients readmitted (all causes)	403	520	923
Total no. of readmissions (all causes)	664	984	1,648
Mean (SD) no. of readmissions per month (all causes)	0.27 (0.21)	0.31 (0.23)	0.29 (0.22)
Total no. of readmission days (all causes)	4,955	7,967	12,922
Mean (SD) no. of readmission days per month (all causes)	1.98 (2.44)	2.46 (2.88)	2.25 (2.70)

SOURCE: Derived from authors' data analysis.

NOTE: SD is standard deviation.

^a Unavailable for Krumholz or Naylor studies (see Exhibit 1 and Note 6 in text); total missing = 16.0 percent.

experience of routine care patients and were much smaller than those achieved by patients in programs led by multidisciplinary teams.

■ **Impact of communication method.** Method of communication also played an important role in program outcomes, after patient covariates were controlled for. In-person communication led to significant reductions in both hospital readmissions and readmissions days per month over routine care—2.5 percent and 5.7 percent reductions, respectively. In contrast, no differences were found in readmissions and readmission days per month between routine care patients and patients in the program using telephonic communication.

■ **Delivery personnel plus communication method.** Not surprisingly, given the results from models that separately include each of the two delivery method features, programs using a single heart failure expert and telephonic communication methods did not produce a significant reduction in hospital readmissions and readmission days per month over routine care. Programs using a single expert that used in-person communication methods achieved reductions in readmissions and readmission days per month that were much larger than those using single experts

EXHIBIT 3
Percentage Reduction In All-Cause Hospital Readmissions And Hospital Readmission Days Per Month Associated With Delivery Personnel And Method Of Communication In Chronic Care Management Programs

	Percent reduction in readmissions per month	Percent reduction in readmission days per month
Delivery personnel		
Single heart failure expert	0.9	2.6
Multidisciplinary team	2.9****	6.4****
Method of communication		
Telephonic	0.4	1.5
In-person	2.5****	5.7****
Delivery + communication		
Single expert + telephonic	0.4	1.5
Single expert + in-person	1.8 ^a	4.3 ^b
Team + in-person	2.9****	6.4****

SOURCE: Authors' analysis.

NOTES: Figures in the exhibit represent authors' conversion of log-transformed regression coefficients from linear mixed-model regressions adjusted for age, sex, history of hypertension, prior heart attack, and original trial. Routine care patients are the reference group in each comparison. N = 2,028.

^ap = 0.05.

^bp = 0.06.

****p < 0.001

and telephonic communication methods; this lower hospital use, though, was not significantly different from the readmission rate for routine care patients. Finally, programs using multidisciplinary teams and in-person communication methods resulted in significant reductions in readmissions and days per month over routine care. Moreover, these reductions were, respectively, roughly 60 percent and 50 percent larger than those for programs using a single heart failure expert and in-person communication methods.

Discussion

Heart failure is the leading cause of hospitalization among the elderly, accounting for roughly 10 percent of total Medicare inpatient spending and 5 percent of total Medicare spending.¹³ The costly treatment pattern and complex care regimen of heart failure have made it a target for chronic care management programs. Such programs embrace the full range of disease management, coordinated care, case management, chronic care models, and variants that include elements from each. Consequently, rigorous evaluation of what works—that is, evaluation that has the potential to produce actionable evidence to support program development—is stymied by the tremendous variability in program design and populations enrolled, and by the lack of a standardized definition of program features. This study addressed a number of those shortcomings by analyzing data assembled from clinical trials that solely enrolled heart failure patients in programs that

shared many features of program content and differed on how this content was imparted. Pooling the raw data from these trials allowed us to examine directly the independent and shared effects of different program features, which is sorely needed to build the evidence base of what works.

Programs using in-person communication achieved a significant reduction in readmissions and readmission days when compared with routine care patients and programs using telephonic communication. Also, programs using single heart failure experts were less effective in reducing hospital readmissions compared with multidisciplinary teams, regardless of the mode of communication used. None of the ten trials used both a multidisciplinary team and telephonic communication, so we were unable to evaluate whether team approaches were significantly more effective under either method of communication, or if team-based care achieved its significant results only when combined with in-person communication. Using published estimates of hospitalization and readmission rates for the national population of people with heart failure, achieving a 2.9 percent reduction in hospital readmissions per month from implementing team-based care management programs could result in an annual reduction of 14,700–29,140 hospital stays nationally.¹⁴

■ **Characteristics of team-based care.** A team-based approach in chronic care management programs for heart failure patients meets the AHA's principles for high-quality disease management programs and the Disease Management Association of America's key components of disease management programs.¹⁵ Team-based care is also a feature of Ed Wagner and colleagues' Chronic Care Model.¹⁶ Our findings mirror these principles; they are congruent with two recent meta-analyses on multidisciplinary approaches noted earlier, and they suggest that the adoption of chronic care management programs founded on team-based care could advance the quality of care for heart failure patients. It is important to note, though, that these quality enhancements accrued from programs where the team included the patient's providers. Quality outcomes may be more modest from team-based care delivered through third-party services where the patient's providers are more tangential members of the team, such as in the CMS's MHS program.

■ **In-person versus telephonic communication.** Our findings on the effectiveness of in-person communication bears further consideration in program design as well. Telephonic communication has become a staple of chronic care management programs, and several meta-analyses denote its association with high-quality outcomes in heart failure. In our study we found that the programs conducted using in-person communication achieved much better outcomes than programs relying exclusively on telephonic communication, whose outcomes were not significantly different than those for routine care patients. These findings emerged from programs that offered state-of-the-art content: patient-focused programs providing comprehensive education and counseling on symptom management and treatment adherence and intervening with patients and providers to ensure optimal medication reg-

imens. The difference in our findings on method of communication compared with those from several recent meta-analyses of telephonic monitoring, in contrast with the agreement between our findings and those from recent meta-analyses of delivery personnel, could be attributable to many factors—for example, differences in study design, and the sample of studies included in the respective analyses. These differences notwithstanding, the improvement in outcomes when including in-person communication in the delivery method, which was also found in the MCCD evaluation that enrolled a broader array of chronically ill patients, argues for designing programs that incorporate different methods of communication and testing the conditions under which they improve program outcomes.

■ **Potential to reduce spending.** It is not clear, though, that implementing programs that employ these enhanced delivery methods will reduce overall spending, which has been an important goal of these programs for both public- and private-sector payers. Complete cost data were not available for all ten trials included in our study, which precluded us from undertaking a cost analysis. Reducing hospital admissions has been theorized as one vehicle through which cost reductions could accrue, although this has yet to be definitively shown.¹⁷ However, cost-neutral quality improvements may accrue from programs using team-based approaches and in-person communication to coordinate and deliver care to chronically ill beneficiaries; evidence of this should be explored.

■ **Study limitations.** There are several limitations to our study. First, as mentioned above, data limitations prevented us from assessing the cost implications associated with the quality improvements we found. Study selection bias presents another potential limitation. The ten trials may represent a limited range of chronic care management programs and outcomes, thus limiting our findings and their interpretation. We endeavored to address this by selecting outcome measures that were routinely identified as outcomes of prime interest to private- and public-sector plans and ones used in a wide range of program evaluation studies. Moreover, we included programs that achieved a range of values on the outcomes we selected, from null findings to positive program effects, and we pooled and reanalyzed these data to add precision to the findings of other evaluation studies. Our conclusions on the influence of delivery methods on readmissions were drawn from an analysis of programs that enrolled only heart failure patients and thus may be limited in their generalizability to other chronic conditions. Extending this assessment to other conditions would aid in filling in the gap in the evidence of chronic care management effectiveness. At the same time, by limiting the sample to a single diagnosis, we were able to directly control for the influence of diagnosis and, through that, improve our understanding of how particular program features render their effects on outcomes.

Although the adaptation of the disease management taxonomy allowed us to undertake a more detailed examination of how delivery methods influenced hospital readmissions, this retrospective assessment of program features might not

have fully captured all meaningful heterogeneity within each feature. For example, although each of the ten trials was rated as offering a comprehensive educational program, there could have been qualitative differences in these educational interventions across studies that could alter their influence on hospital readmissions. Furthermore, these programs were rated uniformly on five of the seven program elements, which limited our ability to discern the influence of all program features, and their combined effects, on outcomes.

Finally, our findings may contrast with those of others for a number reasons: differences found in population-based effectiveness programs versus controlled efficacy studies; differences in enrollment methods and study design that produce observed and unobserved differences in the enrolled population; and differences in intervention fidelity within and between studies. These differences should be viewed as the natural progression of building an evidence base, which, we note, is surprisingly underdeveloped in chronic care management.

■ **Policy implications.** Private- and public-sector health plans have embraced a broad array of programmatic initiatives in chronic care management to enhance the quality and cost-effectiveness of health care for the chronically ill. This diverse array of programs has yielded an equally diverse array of clinical and financial results, obscuring a clear understanding of where and under what circumstances these programs work and, perhaps more importantly, how they work. Policymakers and health plan administrators seeking to undertake successful programs face a number of challenges, including identifying chronically ill populations most likely to benefit from these programs; defining the range and magnitude of “benefits”—that is, quality and cost-effectiveness outcomes—that are achievable; discerning which programs features yield those benefits; and articulating the organizational features that influence program success. In seeking to understand what works in chronic care management programs for heart failure patients, our study offers an important set of guideposts for developing an actionable evidence base upon which to build future initiatives that reward plans and practices that adopt effective programs.

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NOTES

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7. Further details on variable construction are available in the Appendix, online at <http://content.healthaffairs.org/cgi/content/full/28/1/179/DC1>.
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