

# Outcomes and Lessons Learned From Evaluating TRICARE's Disease Management Programs

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**Objective:** To share outcomes and lessons learned from an evaluation of disease management (DM) programs for asthma, congestive heart failure (CHF), and diabetes for TRICARE patients.

**Study Design:** Multiyear evaluation of participants in voluntary, opt-out DM programs. Patient-centered programs, administered by 3 regional contractors, provide phone-based consultations with a care manager, educational materials, and newsletters. The study sample consisted of 23,793 asthma, 4092 CHF, and 29,604 diabetes patients with at least 6 months' tenure in the program.

**Methods:** Medical claims were analyzed to quantify program effect on healthcare utilization, medical costs, and clinical outcomes. Multivariate regression analysis with an historical control group was used to predict patient outcomes in the absence of DM. The difference between actual and predicted DM patient outcomes was attributed to the program. A patient survey collected data on program satisfaction and perceived usefulness of program information and services.

**Results:** Modest improvements in patient outcomes included reduced inpatient days and medical costs, and (with few exceptions) increased percentages of patients receiving appropriate medications and tests. Annual per patient reductions in medical costs were \$453, \$371, and \$783 for asthma, CHF, and diabetes program participants, respectively. The estimated return on investment was \$1.26 per \$1.00 spent on DM services.

**Conclusion:** Findings suggest that the DM programs more than pay for themselves, in addition to improving patient health and quality of life. Lessons learned in program design, implementation, effectiveness, and evaluation may benefit employers contemplating DM, DM providers, and evaluators of DM programs.

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Providing patients with information to manage their medical conditions and encouraging positive change in health-related behavior can lead to improved health and avoidance of costly medical expenditures. The Disease Management Association of America identified asthma, congestive heart failure (CHF), and diabetes among the chronic diseases with the greatest potential for disease management (DM).<sup>1</sup> There is no consensus, however, on whether DM provides the anticipated benefits. Some studies report positive return on investment (ROI),<sup>2-10</sup> whereas others report negative ROI or inconclusive results.<sup>3,11-14</sup>

The Military Health System, through the TRICARE program administered by the TRICARE Management Activity (TMA), provides care to 9.2 million beneficiaries at an annual cost of \$44.8 billion (FY 2009 budget).<sup>15</sup> Among current beneficiaries under age 65 years residing in the United States, analysis of administrative records suggests that approximately 80,000 have asthma, 11,000 have CHF, and 225,000 have diabetes.

TRICARE Management Activity contracted with its 3 regional managed care support contractors (MCSCs) to provide DM services to high-utilization patients with asthma and CHF beginning in September 2006, adding diabetes in June 2007. Although this voluntary, opt-out DM program is ongoing, the findings presented here are based on analysis of patients contacted through September 30, 2008, who had at least 6 months' tenure in the program. The 6-month-tenure criterion was to allow sufficient time for the MCSCs to provide DM services. The September 2008 cutoff was to ensure 100% completeness of medical claims. The analysis sample consisted of 23,793 asthma, 4092 CHF, and 29,604 diabetes patients.

## STUDY DESIGN

TRICARE Management Activity identifies candidates for DM based on high utilization of disease-related services (emergency and outpatient visits, hospitalizations) and, for asthma, high use of short-acting rescue prescriptions. Patient names are forwarded to the MCSCs to verify eligibility and provide DM services. Some patients choose to fully participate and receive personalized telephonic counseling and educational mailings (referred to as "engaged" patients),

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whereas others decline personalized care but receive newsletters. Some patients opt out of the program.

The DM content and services follow industry best practices, including (1) an initial 40- to 50-minute baseline assessment by telephone with a care manager; (2) monthly follow-up telephone calls to set goals, assess progress toward those goals, and educate patients about their conditions and self-management; (3) educational materials specific to the patient's needs (eg, pamphlets, videos, cookbooks); and (4) newsletters and Internet-based materials. All services are educational and are intended to provide patients with disease-specific knowledge and self-management skills.

Two MCSCs consider a patient to have "graduated" 12 months after receiving the baseline assessment, while the third considers a patient to have graduated when goals regarding disease understanding and self-management have been met. After graduation, patients continue to receive newsletters and biannual phone contact.

## METHODS

Best practices for DM evaluation suggest measuring program effect along 4 dimensions: utilization, financial, clinical, and humanistic.<sup>16</sup> Using an encrypted patient identifier, we electronically linked patient DM administrative records, medical claims, and a patient survey. Study protocols were approved by an institutional review board.

### Outcome Metrics

Patient outcome metrics were selected using recommendations of the 2nd Annual Disease Management Outcomes Summit.<sup>17</sup> Utilization metrics (emergency visits and hospital inpatient days) and financial metrics (medical expenditures) for asthma and CHF are disease specific. Claims are counted only when the disease is listed in the first or second diagnosis code position (first diagnosis position only for asthma-related hospitalization and emergency visits).

Only a small portion of diabetes-related medical costs are directly for treatment of diabetes; the majority are associated with complications of diabetes (eg, neurologic symptoms, peripheral vascular disease, cardiovascular disease, renal complications, endocrine complications, ophthalmic complications) and higher use of medical care for general medical conditions.<sup>18</sup> Therefore, for diabetes we report disease-related utilization and cost but focus on total utilization and cost (with claims for injury, pregnancy, congenital abnormalities, and malignant cancer excluded). All medical costs were ad-

### Take-Away Points

A multiyear evaluation of 3 TRICARE disease management (DM) programs for asthma, congestive heart failure, and diabetes looked at patient outcomes along 4 dimensions: utilization, financial, humanistic, and clinical.

- For all 3 diseases, outcome measures moved in the direction anticipated—that is, less emergency use and inpatient care, lower medical costs, and (with few exceptions) increased percentages of patients receiving appropriate medications and tests.
- The estimated return on investment was \$1.26 per \$1.00 spent on DM services.
- These DM programs more than pay for themselves, in addition to improving patient health and quality of life.

justed to 2008 dollars using the medical component of the consumer price index.<sup>19</sup>

Clinical metrics were limited to those available in electronic records and include the percentage of patients receiving an exam or a pharmaceutical in the past year. Asthma metrics were (1) use of long-term controller medications (measured as the percentage of patients with at least 1 dispensed prescription for inhaled corticosteroids, nedocromil, cromolyn sodium, leukotriene modifiers, or methylxanthines); and (2) the percentage of patients with a documented spirometry test. For CHF we determined the percentage of patients with angiotensin-converting enzyme (ACE) inhibitor and beta-blocker prescription fills. Diabetes metrics were (1) the percentage of patients with at least 1 glycosylated hemoglobin (A1C) test, (2) the percentage of patients with at least 1 dilated retinal examination, and (3) the percentage of patients with at least 1 microalbuminuria or clinical albuminuria test.<sup>20</sup>

Humanistic metrics included patient self-assessment of change in quality of life, improved understanding of both the disease and self-management, and overall program satisfaction.

### Data Collection

Patient characteristics and demographics came from the Defense Enrollment Eligibility Reporting System. Healthcare utilization and expenditures came from TRICARE's Medical Data Repository. These included care provided through TRICARE's purchased care program and care provided at military treatment facilities. Information on DM services received and patient DM participation status came from the MCSC patient tracking system.

A disease-specific questionnaire was mailed to patients 6 months after their initial baseline assessment to collect information on change in quality of life, perceived usefulness of the program and materials received, and overall program satisfaction. The survey questionnaire (available from the authors) is designed based on existing survey instruments such as the SF-36 short-form survey, Healthcare Effectiveness Data and Information Set Member Satisfaction Survey,

and the 2006 Disease Management Association of America Participant Satisfaction Survey.<sup>21-24</sup>

### Analysis Sample

A total of 73,156 patients were contacted by the MCSCs as of September 30, 2008. The analysis excluded 8969 patients who had opted out of the program and 4685 patients with fewer than 6 months of program tenure (who had insufficient time to complete the program). Also excluded from the analysis were patients whose complete medical records were no longer available because the patient became Medicare eligible (n = 434), was no longer eligible for TRICARE (n = 1272), or died (n = 25). Patients diagnosed with HIV/AIDS (n = 50) or end-stage renal disease (n = 232) were excluded, with the exception of diabetes patients first diagnosed with end-stage renal disease after becoming eligible for DM.

### Historical Control Group

As these are opt-out DM programs with eligibility determined by high utilization, using nonparticipants as the control group to measure program effect introduces the problem of selection bias, whereas a pre–post evaluation design introduces the problem of regression to the mean.<sup>25-29</sup> To reduce these known biases, we identified a comparable sample of patients, referred to as the historical control group (HCG), and used their outcomes to predict outcomes for the DM population in the absence of a DM program.

The HCG consists of 12,192 asthma, 3247 CHF, and 23,778 diabetes patients who in September 2004 met the same eligibility criteria used to identify candidates for DM in September 2006 and later. We estimated multivariate regressions using patient annual outcomes from October 2004 to September 2005 as the dependent variables. We used Poisson regression to model inpatient days and ambulatory visits, a generalized linear model with gamma distribution to model medical expenditures, and logistic regression to model receipt of tests and pharmaceuticals. Separate regressions were estimated for the Prime (managed care) and non-Prime (preferred provider organization) populations. Regression results are available from the authors upon request.

Covariates included patient characteristics in September 2004 (age, sex, military sponsoring service [Army, Navy, Air Force, other], region [North, South, West]) and utilization between October 2003 and September 2004 (Charlson Comorbidity Index and disease-related inpatient days and ambulatory visits). For asthma we included the number of 30-day asthma-related prescriptions. For CHF we included whether the patient used ACE inhibitors and beta-blockers. For diabetes we included whether the patient had an A1C test in the past year and used total rather than diabetes-specific utilization.

Using regression coefficients estimated with the HCG, we predicted DM patient outcomes for the period following program eligibility based on patient characteristics when first eligible for DM and healthcare utilization patterns during the 12 months prior to DM. Differences between annualized observed and predicted outcomes for the DM population were attributed to DM.

## RESULTS

### DM Process and Patient Participation Outcomes

Although the regression analysis controls for observed differences between the DM and HCG populations, the populations are relatively similar (Table 1). The DM population tended to be slightly less healthy as measured by the Charlson Comorbidity Index, had higher rates of ambulatory visits, and had lower rates of emergency visits and inpatient days during the 12-month identification window.

We first present unadjusted estimates of medical costs before and after DM for both the HCG and the DM populations (Table 2) prior to adjusting for case mix (Table 3) with the HCG regression prediction equations. For the HCG, asthma-related costs dropped by 9.3% when comparing the 12 months used to determine program eligibility with the 12 months after program eligibility. This decline represents regression to the mean—as high utilization is used to define program eligibility. For the DM population, the pre–post change for asthma-related cost was a 32% reduction. Comparing the pre–post change of the DM population with the pre–post change of the HCG, the DM population had a 22.4% (\$660) reduction beyond that explained by regression to the mean. Among CHF patients, there was greater decline among the DM group (–69.7%) than among the HCG (–64.5%) suggesting an average, annual reduction in CHF medical costs of \$787. For diabetes the unadjusted average annual savings estimate was \$367 for diabetes medical costs and \$428 for total medical costs (which includes complications of diabetes).

Using the HCG regression equations, we predicted annual outcomes for the DM population in the absence of DM (Table 3). With the exception of the decrease in the percentage of asthma patients using long-term controllers and the increase in emergency visits among diabetes patients, all other outcomes used to assess MCSC performance moved in the direction anticipated (fewer inpatient days and emergency visits, lower costs, and improved use of medications and disease-related exams). For most outcomes the estimated program effect was statistically significant.

With the exception of asthma-related visits, ambulatory visits were more frequent than predicted for the other diseases.

**Table 1.** Baseline Characteristics of the DM Participants Compared With HCG

Patient Characteristics	Mean (SE)					
	Asthma		Congestive Heart Failure		Diabetes	
	HCG (n = 12,192)	DM (n = 23,793)	HCG (n = 3247)	DM (n = 4092)	HCG (n = 23,778)	DM (n = 29,604)
<b>Demographics</b>						
Age, y	38.4 (0.18)	35.1 <sup>a</sup> (0.13)	56.8 (0.13)	56.5 (0.12)	53.0 (0.06)	52.6 <sup>a</sup> (0.06)
Male, %	38	40 <sup>a</sup>	51	51	44	44
<b>Region, %</b>						
North	33	30 <sup>a</sup>	29	24 <sup>a</sup>	31	24 <sup>a</sup>
South	36	40 <sup>a</sup>	46	52 <sup>a</sup>	41	51 <sup>a</sup>
West	31	29 <sup>a</sup>	25	24	28	24 <sup>a</sup>
<b>Sponsor's service branch, %</b>						
Army	37	41 <sup>a</sup>	40	39	39	39
Navy	25	23 <sup>a</sup>	25	25	25	25
Air Force	30	28 <sup>a</sup>	27	29	29	28 <sup>a</sup>
Other	7	8	7	7	7	7 <sup>a</sup>
<b>Insurance, %</b>						
Prime (managed care)	66	76 <sup>a</sup>	50	60 <sup>a</sup>	63	63
<b>Health status (CCI)</b>	0.18 (0.005)	0.25 (0.004) <sup>a</sup>	2.32 (0.032)	2.60 (0.030) <sup>a</sup>	0.74 (0.008)	0.93 (0.008) <sup>a</sup>
<b>Use of health services in the 12 months before DM identification</b>						
<b>Disease related</b>						
Emergency visits	0.55 (0.01)	0.52 (0.01) <sup>a</sup>	0.64 (0.02)	0.61 (0.02)	0.60 (0.01)	0.65 (0.01) <sup>a</sup>
Inpatient days	0.15 (0.01)	0.14 (0.01)	5.04 (0.13)	4.62 (0.10) <sup>a</sup>	1.07 (0.03)	0.87 (0.02) <sup>a</sup>
Ambulatory visits	3.45 (0.05)	3.91 (0.04) <sup>a</sup>	6.81 (0.19)	7.13 (0.14)	6.21 (0.04)	6.25 (0.04)
<b>Total</b>						
Emergency visits	1.19 (0.02)	1.22 (0.02)	2.62 (0.07)	2.49 (0.06)	1.75 (0.02)	1.81 (0.02)
Inpatient days	0.44 (0.03)	0.40 (0.01)	8.92 (0.26)	8.25 (0.20) <sup>a</sup>	2.47 (0.05)	2.13 (0.04) <sup>a</sup>
Ambulatory visits	14.77 (0.17)	17.78 (0.12) <sup>a</sup>	39.46 (0.57)	44.77 (0.52) <sup>a</sup>	22.11 (0.15)	23.33 (0.14) <sup>a</sup>

CCI indicates Charlson Comorbidity Index; DM, disease management; HCG, historical control group.  
<sup>a</sup>Mean value was significantly different from HCG at the .05 level.

The percentage of CHF patients using ACE inhibitors and beta-blockers was higher than predicted, yet the total number of pharmaceutical 30-day prescriptions filled was lower than predicted for all diseases.

Estimates of average annual medical savings per patient illustrate the potential short-term program effect: \$453 for asthma, \$371 for CHF, and \$783 for diabetes. For comparison, estimates from the literature (which can differ from those for this program in terms of population served and intensity of services) suggest average annual per patient savings of \$908 for asthma, \$4503 for CHF, and \$626 for diabetes (in 2008 dollars).<sup>4,30-32</sup> These averages come from randomized clinical trials, quasi-experimental studies, and pre-post studies. In studies that used a quasi-experimental

design similar to our use of an HCG, average annual per patient savings were closer (but still higher) to estimates of this DM program—\$630 for asthma, \$1400 for CHF, and \$1292 for diabetes.<sup>4</sup>

Cumulative DM program costs from September 2006 to September 2008 were estimated at \$22.7 million (including evaluation costs but excluding TMA administrative costs for oversight and contract implementation). Average, annual per capita savings estimates for all patients with at least 6 months of tenure in DM (adjusting for average tenure of this population) indicated cumulative gross savings of \$28.5 million. The 1.26 benefit-to-cost ratio suggests that each \$1.00 invested by TRICARE in DM returned \$1.26 in short-term medical savings.

■ **Table 2.** Unadjusted Comparison of Pre-DM and Post-DM Medical Costs

DM Program and Cost Category	Annual Cost						Unadjusted Difference in Difference, % (\$)
	Historical Control Group			DM Group			
	Mean		Pre-Post Change, %	Mean		Pre-Post Change, %	
	Pre-DM, \$	Post-DM, \$		Pre-DM, \$	Post-DM, \$		
<b>Asthma</b>							
Asthma related	2751	2494	-9.3	2948	2012	-31.8	-22.4 (-660)
Total	7864	7769	-1.2	7975	7013	-12.1	-10.9 (-869)
<b>CHF</b>							
CHF related	12,555	4461	-64.5	14,848	4495	-69.7	-5.3 (-787)
Total	32,773	18,375	-43.9	35,764	19,890	-44.4	-0.5 (-179)
<b>Diabetes</b>							
Diabetes related	5215	3777	-27.6	5169	3378	-34.6	-7.1 (-367)
Total	14,376	11,879	-17.4	14,264	11,359	-20.4	-3.0 (-428)

CHF indicates congestive heart failure; DM, disease management.

### Patient Survey Results

Humanistic values were analyzed through a mailed survey to participants in the programs for data on program satisfaction and perceived usefulness of information and services received. Among 17,287 patients who received surveys, 6656 returned valid responses by September 30, 2009, for an adjusted response rate of 39%. There were 43 unusable responses, 812 surveys were undeliverable because of an invalid address, and 27 surveys were sent to deceased program participants. A total of 2895 asthma, 825 CHF, and 2936 diabetes patients responded to the survey. Regression analysis found that patient characteristics were correlated with probability of survey response, but uncorrelated with answers to individual questions. To compensate for potential nonresponse bias, we constructed weights using the normalized logistic weighting approach.<sup>33</sup>

In response to the question “Thinking about all aspects of your disease management program, how would you rate your experience overall?” the majority of respondents rated their experiences overall quite favorably with “good,” “very good,” or “excellent” marks—90% of adult and 93% of pediatric asthma patients, 85% of CHF patients, and 89% of diabetes patients.

In response to the question “Would you say that your disease management program has helped you to improve your life?” 63% of adult and 67% of pediatric asthma patients, 64% of CHF patients, and 68% of diabetes patients agreed or strongly agreed with the statement.

The majority of respondents stated that participation in DM helped them to better manage different aspects of their disease (Table 4).

### DISCUSSION

With the exception of a few outcome measures, this evaluation suggests that TRICARE’s DM programs were effective in all 4 evaluation dimensions: (1) less utilization of emergency and hospital services, (2) increased appropriate use of medical exams and pharmaceuticals, (3) reduced annual per capita medical expenditures, and (4) overall satisfaction with the program and the perception that the program helped increase patients’ understanding of their disease, self-management skills, and quality of life. Most of the improvements were statistically significant. Medical savings from reduced emergency visits and hospitalizations were partially offset by increased costs associated with more physician office and outpatient visits.

In response to the survey question about usefulness of the program in teaching self-management skills, asthma patients perceived the program to be most useful in increasing knowledge of what can trigger an asthma attack, establishing an asthma action plan, and increasing understanding of when to call or visit their doctor. Areas in which CHF and diabetes patients found the program to be most useful were learning how to take their medications and knowing when to call or visit their doctor.

Program costs were not tracked by disease, so ROI estimates for individual disease programs were unavailable. The overall 1.26 ROI estimate is lower than the average estimates of ROI from the literature of 2.72 for asthma, 2.78 for CHF, and 2.85 for diabetes.<sup>4,30-32</sup> Estimates from the literature tend to have higher per patient DM costs—possibly suggesting a greater level of DM intensity but also reflecting the lack of

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■ **Table 3.** Actual Versus Expected Annual Healthcare Use and Medical Cost per Patient With at Least 6 Months of Tenure in DM<sup>a</sup>

Disease and Measure	Actual (SE)	Expected <sup>b</sup> (SE)	Difference	Proportional Effect
<b>Asthma</b>				
<b>Asthma related</b>				
<b>Inpatient days</b>	<b>0.05 (0.003)</b>	<b>0.06 (0.001)</b>	<b>-0.01<sup>c</sup></b>	<b>-0.13</b>
<b>Emergency visits</b>	<b>0.18 (0.005)</b>	<b>0.25 (0.002)</b>	<b>-0.06<sup>c</sup></b>	<b>-0.25</b>
Outpatient/ambulatory	2.75 (0.03)	2.94 (0.02)	-0.19 <sup>c</sup>	-0.06
Prescriptions, 30 day	16.41 (0.07)	18.68 (0.04)	-2.27 <sup>c</sup>	-0.12
<b>Medical costs</b>	<b>\$2012 (\$21)</b>	<b>\$2465 (\$10)</b>	<b>-\$453<sup>c</sup></b>	<b>-0.18</b>
<b>Total</b>				
Inpatient days	0.41 (0.020)	0.47 (0.008)	-0.06 <sup>c</sup>	-0.13
Emergency visits	0.81 (0.012)	0.83 (0.006)	-0.02 <sup>c</sup>	-0.03
Outpatient/ambulatory	16.41 (0.13)	15.38 (0.07)	1.04 <sup>c</sup>	0.07
Prescriptions, 30 day	56.63 (0.30)	59.81 (0.23)	-3.18 <sup>c</sup>	-0.05
Medical costs	\$7013 (\$74)	\$7844 (\$39)	-\$832 <sup>c</sup>	-0.11
<b>Percentage on long-term controllers</b>	<b>0.89</b>	<b>0.91</b>	<b>-0.02<sup>c,d</sup></b>	<b>-0.02</b>
<b>Percentage with spirometry</b>	<b>0.27</b>	<b>0.21</b>	<b>0.06<sup>c</sup></b>	<b>0.26</b>
<b>CHF</b>				
<b>CHF related</b>				
<b>Inpatient days</b>	<b>1.13 (0.08)</b>	<b>1.21 (0.02)</b>	<b>-0.08</b>	<b>-0.07</b>
<b>Emergency visits</b>	<b>0.20 (0.01)</b>	<b>0.22 (0.01)</b>	<b>-0.02</b>	<b>-0.09</b>
Outpatient/ambulatory	3.05 (0.10)	2.94 (0.05)	0.11	0.04
Prescriptions, 30 day	26.29 (0.28)	30.42 (0.23)	-4.13 <sup>c</sup>	-0.14
<b>Medical costs</b>	<b>\$4495 (\$239)</b>	<b>\$4866 (\$72)</b>	<b>-\$371</b>	<b>-0.08</b>
<b>Total</b>				
Inpatient days	3.81 (0.20)	3.64 (0.06)	0.17	0.05
Emergency visits	1.52 (0.05)	1.38 (0.02)	0.13 <sup>c</sup>	0.10
Outpatient/ambulatory	30.19 (0.45)	26.95 (0.21)	3.23 <sup>c</sup>	0.12
Prescriptions, 30 day	90.53 (0.92)	95.51 (0.76)	-4.98 <sup>c</sup>	-0.05
Medical costs	\$19,890 (\$562)	\$20,041 (\$219)	-\$152	-0.01
<b>Percentage on ACE inhibitors</b>	<b>0.56</b>	<b>0.52</b>	<b>0.04<sup>c</sup></b>	<b>0.09</b>
<b>Percentage on beta-blockers</b>	<b>0.78</b>	<b>0.66</b>	<b>0.12<sup>c</sup></b>	<b>0.18</b>
<b>Diabetes</b>				
<b>Diabetes related</b>				
Inpatient days	0.28 (0.012)	0.32 (0.005)	-0.05 <sup>c</sup>	-0.15
Emergency visits	0.22 (0.005)	0.20 (0.002)	0.02 <sup>c,d</sup>	0.09
Outpatient/ambulatory	4.99 (0.03)	4.87 (0.02)	0.13 <sup>c</sup>	0.03
Prescriptions, 30 day	20.92 (0.09)	22.03 (0.07)	-1.11 <sup>c</sup>	-0.05
Medical costs	\$3378 (\$31)	\$3627 (\$15)	-\$249 <sup>c</sup>	-0.07
<b>Total</b>				
<b>Inpatient days</b>	<b>1.42 (0.04)</b>	<b>1.50 (0.01)</b>	<b>-0.08</b>	<b>-0.05</b>
<b>Emergency visits</b>	<b>1.12 (0.02)</b>	<b>1.06 (0.01)</b>	<b>0.06<sup>c,d</sup></b>	<b>0.06</b>
Outpatient/ambulatory	19.89 (0.14)	18.94 (0.07)	0.95 <sup>c</sup>	0.05
Prescriptions, 30 day	81.57 (0.31)	87.41 (0.26)	-5.84 <sup>c</sup>	-0.07
<b>Medical costs</b>	<b>\$11,359 (\$114)</b>	<b>\$12,142 (\$50)</b>	<b>-\$783<sup>c</sup></b>	<b>-0.07</b>
<b>Percentage with A1C test</b>	<b>0.61</b>	<b>0.58</b>	<b>0.02<sup>c</sup></b>	<b>0.04</b>
<b>Percentage with retinal exam</b>	<b>0.26</b>	<b>0.23</b>	<b>0.02<sup>c</sup></b>	<b>0.10</b>
<b>Percentage with microalbumin urine test</b>	<b>0.39</b>	<b>0.33</b>	<b>0.06<sup>c</sup></b>	<b>0.18</b>

A1C indicates glycosylated hemoglobin; ACE, angiotensin-converting enzyme; CHF, congestive heart failure; DM, disease management.

<sup>a</sup>Metrics in bold text indicate outcomes used to assess performance of the 3 regional DM providers.

<sup>b</sup>Predicted based on analysis of the historical control group.

<sup>c</sup>Difference was statistically significant at the .05 level.

<sup>d</sup>Finding was counterintuitive.

■ METHODS ■

■ **Table 4.** Patient Responses to Survey Item: “Please indicate how much you agree or disagree that participation in the disease management program has helped you”

Disease and Response	Percentage <sup>a</sup>				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
<b>Pediatric asthma (n = 610)</b>					
Control your breathlessness by changing your activity levels	4	11	34	38	13
Use a peak flow meter	4	7	25	41	22
Know when you should call or visit your doctor about your asthma	2	3	16	46	34
Know how to take your medication	2	4	18	38	39
Know what things can trigger an asthma attack	2	3	16	42	37
Use an inhaler	2	5	19	39	35
Establish an asthma action plan	2	4	18	39	38
<b>Adult asthma (n = 2285)</b>					
Control your breathlessness by changing your activity levels	3	7	34	45	11
Use a peak flow meter	5	7	31	40	16
Know when you should call or visit your doctor about your asthma	2	4	16	49	29
Know how to take your medication	3	4	19	41	34
Know what things can trigger an asthma attack	2	4	18	43	33
Use an inhaler	2	4	21	42	30
Establish an asthma action plan	3	5	21	43	29
<b>CHF (n = 825)</b>					
Control your shortness of breath by changing your activity levels	3	6	29	49	12
Control your weight	3	9	29	44	15
Know when you should call or visit your doctor about your CHF	3	4	15	50	29
Know how to take your medication	2	3	17	47	32
Monitor your blood pressure	2	3	19	49	26
Establish a CHF plan	3	7	26	46	19
Monitor your diet	2	4	22	51	20
Monitor your stress	3	6	25	45	21
<b>Diabetes (n = 2936)</b>					
Check your blood glucose to make sure it is in control	3	3	16	46	32
Monitor your weight	3	5	22	48	23
Know when you should call or visit your doctor about your diabetes	3	3	15	46	34
Know how to take your medication	3	3	17	41	36
Check your blood pressure to make sure it is in control	3	5	22	44	26
Follow a recommended diabetes diet	3	5	24	45	23
Follow a diabetes action plan	3	5	21	48	24
CHF indicates congestive heart failure. <sup>a</sup> Rows might not add to 100% because of rounding.					

economies of scale compared with the large DM population in TRICARE. A review by Goetzel et al found that for 12 asthma DM studies, the ROI ranged from  $-0.73$  to  $8.37$ .<sup>4</sup> These studies averaged 449 patients with an average tenure of 1.3 years. The same review reported that for 12 CHF studies, the ROI ranged from  $-2.74$  to  $14.18$ ; these studies averaged 170 patients with an average tenure of 1 year.<sup>4</sup> That review also reported ROIs of 1.04 and 2.23 from 2 DM studies; 3 additional diabetes studies had ROIs of 2.43, 3.37, and 4.34.<sup>4,30-32</sup>

Our analyses suggested that many asthma patients initially selected for DM based on high use of outpatient services or pharmaceuticals alone were at low risk for hospitalization or emergency care if they were already receiving appropriate long-term controller medications. Based on these findings, TMA revised the asthma program eligibility criteria in April 2008, resulting in a more than 40% reduction in the number of annual asthma DM program candidates and a higher correlation between risk-level assignment and probability of a future emergency visit or hospitalization event. Other analyses (not reported here) suggest that among the diabetes population, DM program benefits were greater for patients who had indications of uncontrolled diabetes in the 12 months prior to DM (relative to patients with no indications of uncontrolled diabetes during the 12-month period).

Consistent with the philosophy of performance-based contracting, the MCSCs were given flexibility in designing their DM programs. Although this flexibility provided opportunities for a "natural experiment" to determine whether differences in program design or implementation affected patient outcomes, the 3 MCSCs designed relatively similar programs following industry best practices. Modest regional differences in patient outcomes were difficult to attribute to specific practices.

Because the evaluation design started after program implementation, we faced data, statistical, and logistical challenges that influenced the choice of evaluation methods and the outcome metrics. The voluntary, opt-out nature of the program precluded use of a randomized control design and introduced the potential for selection bias if nonparticipants were used as the control group. Although use of the HCG introduced potential bias from secular utilization and treatment trends, our use of patients' pre-DM eligibility utilization to adjust for case mix for post-DM utilization outcomes helped reduce this potential bias.<sup>2</sup> Using the HCG, however, allowed us to predict expected outcomes for the entire population of DM-eligible patients, irrespective of participation level and controlling for a patient's pre-DM characteristics. The evaluation results, therefore, were influenced by the proportion of patients participating at different levels of intensity and the program effect for each participation level.

Having the evaluation design in place before the start of the DM program would have facilitated standardizing the definitions and protocols used by the 3 MCSCs to (1) track patient participation status, (2) determine graduation from the program, (3) code reasons for nonparticipation, and (4) track goal setting and achievements.

Logistical and resource constraints prevented collection of information on clinical measures through a medical record review. Consequently, clinical measures consisted of whether patients received exams rather than actual exam results. Likewise, information on patient clinical readings (eg, body mass index, blood pressure, A1C levels) were unavailable for the evaluation. Such information would be useful to assess the extent to which the DM program directly influenced healthcare utilization by providing information on appropriate use of services and the extent to which the program influenced utilization by improving patients' underlying health.

Findings from this evaluation are generally consistent with those of other DM evaluations in terms of ROI. However, because the nature and intensity of DM services can differ significantly across programs and because patient acuity mix varies substantially, caution is needed when making comparisons across studies. Indications are that TRICARE's DM programs are cost-effective; increase appropriate use of tests, pharmaceuticals, and ambulatory visits while reducing hospitalizations; and improve patient health and quality of life.

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